TA. 1823

Auto-tuned HF Linear Amplifier

Technical Manual

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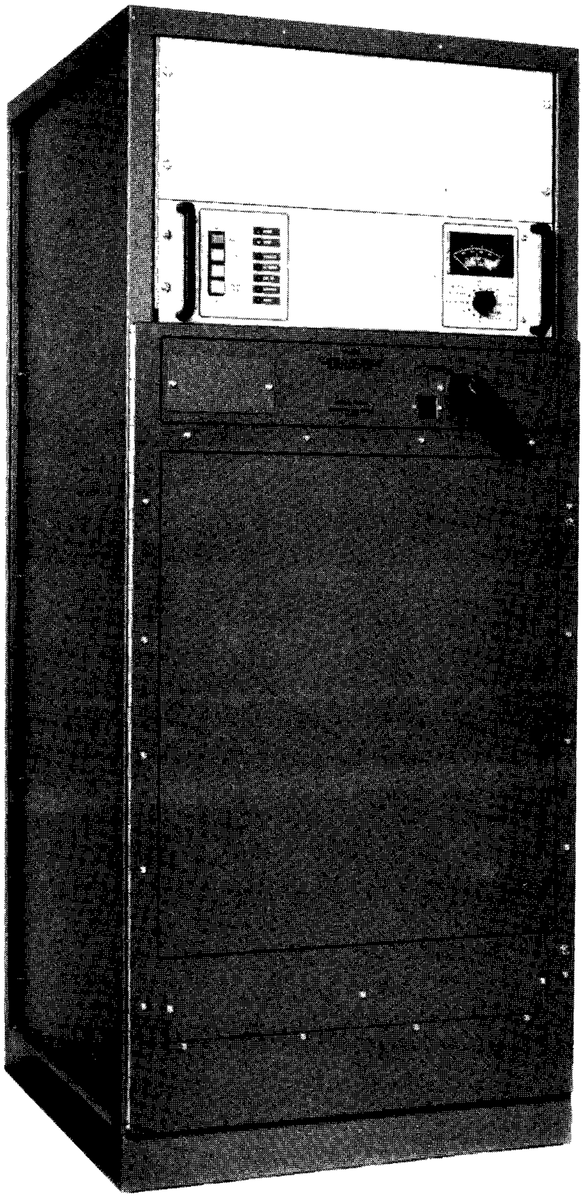
HANDBOOK AMENDMENTS

Amendments to this handbook (if any), which are on coloured paper for ease of identification, will be found at the rear of the book. The action called for by the amendments should be carried out by hand as soon as possible.



RACAL
TH 2354

1 KW Linear Amplifier Type TA 1823

TA 1823 AUTO-TUNED

HF LINEAR AMPLIFIER

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ILLUSTRATIONS

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TECHNICAL SPECIFICATION

Frequency Range:	1.6 MHz to 30 MHz
Power Output Level:	1 kW ± 1 dB PEP and CW
Load Impedance:	50 ohms nominal, unbalanced
Load VSWR:	3:1 maximum
Input Level:	25 mW to 250 mW
Input Impedance:	50 ohms nominal, unbalanced
Input VSWR:	1.5:1 maximum
Intermodulation Products:	Better than -36 dB relative to either tone in a standard two tone test (CCIR Rec. 326-2).
Harmonic Emission:	Better than -43 dB relative to PEP (CCIR Rec. 329-1).
Hum and Noise (in band):	Better than -40 dB relative to PEP.
Wideband Noise:	Better than -130 dB relative to 1 kW in a 3 kHz bandwidth.
Automatic Tuning Time:	10 seconds maximum
Status Indications:	Supply ON Standby Selected EHT Selected Ready Extended Control Selected
Cooling:	Forced air by internal blower. Inlet filter and exhaust in rear panel.
Power Supply:	200 V to 250 V, 6%, single phase, 47 Hz to 63 Hz.
Power Consumption:	3.5 kVA maximum
Environmental Conditions:	Operating temperature: $-10^{o}C$ to $+55^{o}C$ Storage temperature: $-40^{o}C$ to $+70^{o}C$ Relative humidity: 95% at $40^{o}C$
Dimensions:	Height 1310 mm (51.6 in) Width 555 mm (21.9 in) Depth 570 mm (22.4 in)
Weight (excluding drive unit):	250 kg (550 lb) nominal

CHAPTER 1

GENERAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The TA 1823 Linear Amplifier accepts a low-level r.f. signal in the range 1.6 MHz to 30 MHz and provides an amplified output.

2. The TA 1823 may be used in conjunction with any drive system having the appropriate electrical parameters. In particular the TA 1823 is designed for use with the Racal MA 1720, MA 1723 and MA 1724 Exciters. The r.f. input requirement is 100 mW (nominal) at 50 ohm source impedance, but levels up to 250 mW can be accommodated.

3. The r.f. output level is 1 kW ± 1dB, p.e.p. or CW, into 50 ohms load. The r.f. amplification is effected in two steps. A three-stage wideband amplifier raises the signal level to about 25 W and then a single-stage tuned amplifier provides the final output. The wideband amplifier, which employs solid-state devices, operate in class A. The final amplifier stage is a single ceramic tetrode valve operating in class AB1.

4. The power amplifier stage uses a PI-L output network to transform the load impedance presented by the antenna to that required at the PA valve anode. The network uses switched, fixed-value ceramic capcitors and servo-driven variable inductors.

5. During the tuning procedures, the linear amplifier is operated at reduced power output. On completion of the tuning, the overall stage gain is set to its nominal value and then maintained constant by means of an automatic level control (ALC) system.

6. Provision is made for manual tuning of the linear amplifier, for maintenance purposes or in the event of a fault in the auto-tune system.

7. The TA 1823 can be operated either locally, using the front panel controls, or from an extended control point. Comprehensive metering and monitoring facilities are provided. Protection circuits are incorporated which prevent damage to the equipment under fault conditions.

8. The Linear Amplifier is powered from a single-phase 200 V to 250 V a.c. supply via input transformers whose primaries are tapped in 10 V steps. All necessary operating potentials are derived from in-built power supply units.

CONSTRUCTION

9. The complete linear amplifier housed in a single free-standing cabinet, with built-in facilities for forced-air cooling.

10. The equipment in the cabinet consists of the following major items:

    (1) The RF Power Amplifier Assembly

(2) The Drive Amplifier Assembly

(3) The Control Unit

(4) The Servo-Drive Circuits

(5) The VSWR Unit

(6) The EHT Power Supply

(7) The Auxiliary Power Supplies

11. Space is provided at the top of the cabinet for the incorporation of an Exciter Unit, such as the Racal MA 1720, MA 1723, or MA 1724.

12. The RF Power Amplifier is housed in a screened compartment on a hinged front panel. Opening this 'door' provides access to the rear of the RF Amplifier and to the Drive Amplifier and Servo Amplifier Stages; it also provides access to the power supply items housed in the lower part of the cabinet.

13. The front panel of the RF compartment is detachable, for maintenance purposes. A safety interlock ensures that all a.c. supply inputs are disconnected before access to the high-voltage points is attempted.

14. The Control Unit is of standard rack-mounting form. It carries all the controls and indicators required for normal operation. Comprehensive metering facilities are provided.

BRIEF TECHNICAL DESCRIPTION

Switching-On

15. The switch-on sequence is initiated by operating the Cabinet Master switch and then selecting the Standby operation mode. This action activates the low-voltage d.c. supplies for the control circuits and starts the PA warm-up timer.

16. When the warm-up period has elapsed and the PA valve heater has attained its normal operating temperature the EHT-on mode is selected.

Auto Tuning

17. The Auto-Tune adjustments are carried out in three stages viz coarse-tune, ramp and fine-tune.

18. The entire sequence is initiated by a Reset instruction. This selects the coarse-tune condition and mutes the Drive Amplifier stages.

19. During the coarse-tune sequence, the equipment identifies the 'new' operating frequency and selects the fixed capacitive elements of the output network accordingly. The servo motors are started, causing the Tune inductor and the Load inductor to be set to predetermined start-of-tune positions.

20. During the ramp sequence, the Drive Amplifier is enabled and the PA stage is operated with a reduced level of grid drive. The Load inductor is held at its present setting. The Tune inductor is adjusted such that the PA anode circuit is close to resonance.

21. Finally, during the fine-tune sequence adjustments are made to both the Tune and Load inductors such that the desired resistive load is presented to the PA Valve anode and corrections are made to compensate for any reactive component of the external load.

22. When this action has been completed, both servo motors come to rest; this condition is interpreted as 'Tuning Completed, Ready for Traffic'. The Ready condition causes the PA drive level to be set to its 'Operate' value, and it is then maintained at that level by the ALC circuit.

CHAPTER 2

INSTALLATION

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CHAPTER 2

INSTALLATION

GENERAL

1. The Linear Amplifier is shipped with the following items packed separately. The fixing instructions for these items are given in para. 5 to 9.

   (1) EHT Transformer Assembly.
   (2) Auxiliary Transformer Assembly.
   (3) Drive Amplifier Assembly.
   (4) The PA Valve.
   (5) The Control Unit.

FLOOR MOUNTING

2. According to local requirements the cabinet may be free-standing, or preferably bolted to the floor using the four mounting points in the bottom mounting plate.

3. Provision is also made for the use of anti-vibration mountings which are attacked to the same four points and for top-steady brackets at the top of the cabinet.

4. The minimum clearance to provide for correct ventilation and for access for maintenance purposes are given in Fig. 2-1.

   CAUTION If the cabinet is not fixed to the floor, extreme caution must be exercised when fitting or withdrawing the Exciter Unit (located in the space at the top of the cabinet) as the assembly may become top-heavy if the main transformer assemblies have not been fitted.

FITTING THE AUXILIARY TRANSFORMER ASSEMBLY

5. (1) Open the RF Compartment door and hinge back.

   (2) Stand the assembly (T2, T3, L1, C2, etc) on the left-hand-front area of the cabinet baseplate.

   (3) Remove the two screws securing capacitor C2 and lift the capacitor clear from the clips at the rear.

   (4) Make connections to the main cableform as detailed in Table 1.

   (5) Connect the primary taps of transformer T2, and those of T3, to suit the local supply voltage.

   (6) Refit C2 and make the appropriate connections.

   (7) Ease the assembly rearwards, engageing the mounting plate into the guides.

(8) Secure the assembly with four screws, two at the front of the mounting plate and two at the top rear of the assembly.

FITTING THE EHT TRANSFORMER ASSEMBLY

6. (1) Remove the lower door support assembly (four screws at right-hand side).

(2) Remove the screws securing tagblock TB1 and lift aside to the extent of the cableform.

(3) Stand the EHT transformer assembly on the right-hand-front area of the cabinet baseplate.

(4) Make connections to the main cableform as detailed in Table 1.

(5) Connect the primary taps of the transformer (and the links to T2 and T3) to suit the local supply voltage.

(6) Ease the assembly rearwards to its normal mounting position.

(7) Secure the assembly with four screws, two at the front of the mounting plate and two at the top rear of the assembly.

(8) Refit the tagblock and the door support assembly which were removed at operations (1) and (2).

FITTING THE DRIVE AMPLIFIER ASSEMBLY

7. (1) Position the assembly to the right of the air duct, with the connectors uppermost.

(2) Secure the assembly with four screws, two each through the top and bottom flanges.

(3) Engage the multiway connector with 2SK1.

(4) Connect the coaxial cable from the control unit to 2PL2 (input) and connect the coaxial cable from the PA grid compartment to 2PL1 (output).

FITTING THE PA VALVE

8. (1) Check that the RF Compartment door is closed and secure.

(2) Remove the eighteen screws securing the front panel, leaving the cover plate for the manual tuning controls in place.

(3) Ease the front panel assembly outwards at the top, and then lift clear from the two slots at the bottom.

(4) Remove the eight screws securing the cover plate for the PA anode compartment and lift the cover plate clear.

(5) Holding the valve in the horizontal altitude, ease it into the chimney assembly and engage the centre spigot of the valve holder with the base of the valve.

(6) Gently slide the valve into place and then rotate about 60 degrees in a clockwise direction until secure.

(7) Loosen the screw in the anode connector and fit the connector to the valve anode. Dress the flexible connector to its normal position and tighten the screw.

(8) Check that there is adequate clearance between the anode connections and the surrounding metalwork.

(9) Refit the cover plate to the anode compartment and secure with the eight screws removed at operation (4).

(10) Refit the front panel assembly and secure with eighteen screws.

FITTING THE CONTROL UNIT

9. (1) Provide a suitable temporary support for the Control Unit.

(2) Engage the multiway connectors with PL1 and SK1, noting that the cableforms are 'cross-connected' from their respective slots in the power supply tray.

(3) Connect the coaxial cables to SK2 and SK3.

(4) Slide the Control Unit into place, making sure that the lower lip of the rear panel engages with the two hold-down clips (these clips are attached to the power supply tray).

(5) Secure the unit with the four front-panel screws.

CABINET EARTH CONNECTION

10. An earth strap should be connected between the earth point at the rear of the cabinet and the main station earthing system.

POWER CONNECTIONS

11. The Linear Amplifier requires a 200 V to 250 V single-phase supply of 3.5 kVA rating. The line, neutral and earth connections are made to the appropriate terminals of tagblock TB1.

12. The point of entry of the supply cable is via the slot at the bottom rear of the cabinet, and the cable should be dressed between the auxiliary and EHT transformer assemblies.

EXTENDED-CONTROL LINES

13. The interconnections for extended control of the Linear Amplifier are made via tagblock TB10, which is located at the top rear of the cabinet. The connections are listed in Table 2; note that an Interlock link is always required between terminals 8 and 9 of TB10.

TABLE 1: CONNECTIONS: EHT AND AUXILIARY ASSEMBLIES

Wire Number	Colour	Sleeve	Conductor Size		Connects to
1	Brown	-	56/0.3	T1 Primary, 240 V	RLA-1
2	Blue	-	56/0.3	T1 Primary, 0 V	S1C
3	Blue	-	16/0.2	T1 Primary, 0 V	T2 Primary
4	Blue	-	16/0.2	T1 Primary, 0 V	T3 Primary
5	Black	-	56/0.3	T1 Screen	E Tag
6	Brown	Red	16/0.2	T1 Secondary, 240 V	TS3/1
7	Brown	-	16/0.2	T1 Secondary, 0 V	TS3/2
8	White	Green	16/0.2	T1 Secondary, 3390 V	D1 (AC)
9	White	Green	16/0.2	T1 Secondary, 0 V	D2 (AC)
10	Brown	-	16/0.2	T2 Primary, 240 V	RLB-1
11	Brown	-	16/0.2	T2 Primary, 240 V	TB5/1
12	Blue	Yellow	16/0.2	T2 Primary, 0 V	TB5/2
-	Blue	-	16/0.2	T2 Primary, 0 V	T1 Primary
13	Black	-	24/0.2	T2 Screen	E Tag
14	Red/Green	-	7/0.2	T2 Secondary, 73 V	TS3/3
15	Red/Green/ Orange	-	7/0.2	T2 Secondary, 0 V	TS3/4
16	Brown/White	-	84/0.3	T2 Secondary, 6 V	PA Valve
17	Brown/White	Black	84/0.3	T2 Secondary, 0 V	Heater
18	Brown	Orange	16/0.2	T3 Primary, 240 V	FS3
-	Blue	-	16/0.2	T3 Primary, 0 V	T1 Primary
19	Black	-	24/0.2	T3 Screen	E Tag
20	Orange/Blue	-	16/0.2	T3 Secondary D, 14.5 V	TS3/6
21	Orange/Black	-	16/0.2	T3 Secondary D, 0 V	TS3/7
22	Orange/Grey	-	16/0.2	T3 Secondary C, 14.5 V	TS3/7
23	Brown/Black	-	16/0.2	T3 Secondary C, 0V	TS3/8
24	White	Black	50/0.25	T3 Secondary B, 30 V	TS2/1
25	White	Black	50/0.25	T3 Secondary B, 0 V	TS2/2

TABLE 1: CONNECTIONS: EHT AND AUXILIARY ASSEMBLIES (cont'd)

Wire Number	Colour	Sleeve	Conductor Size		Connects to
26	Orange/Brown	-	16/0.2	T3 Secondary A, 115 V	RLB-2
27	Black	-	16/0.2	T3 Secondary A, 0 V	E Tag
28	White	Red	16/0.2	C2, Tag A	RF Comparment (EHT)
29	White	-	16/0.2	C2, Tag A	C1, Tag B
30	White	Yellow	16/0.2	L1, Tag B	C2, Tag B
31	White	Yellow	16/0.2	L1, Tag B	EHT Monitor Board
32	White	Black	16/0.2	L1, Tag A	D1, D2 (negative)

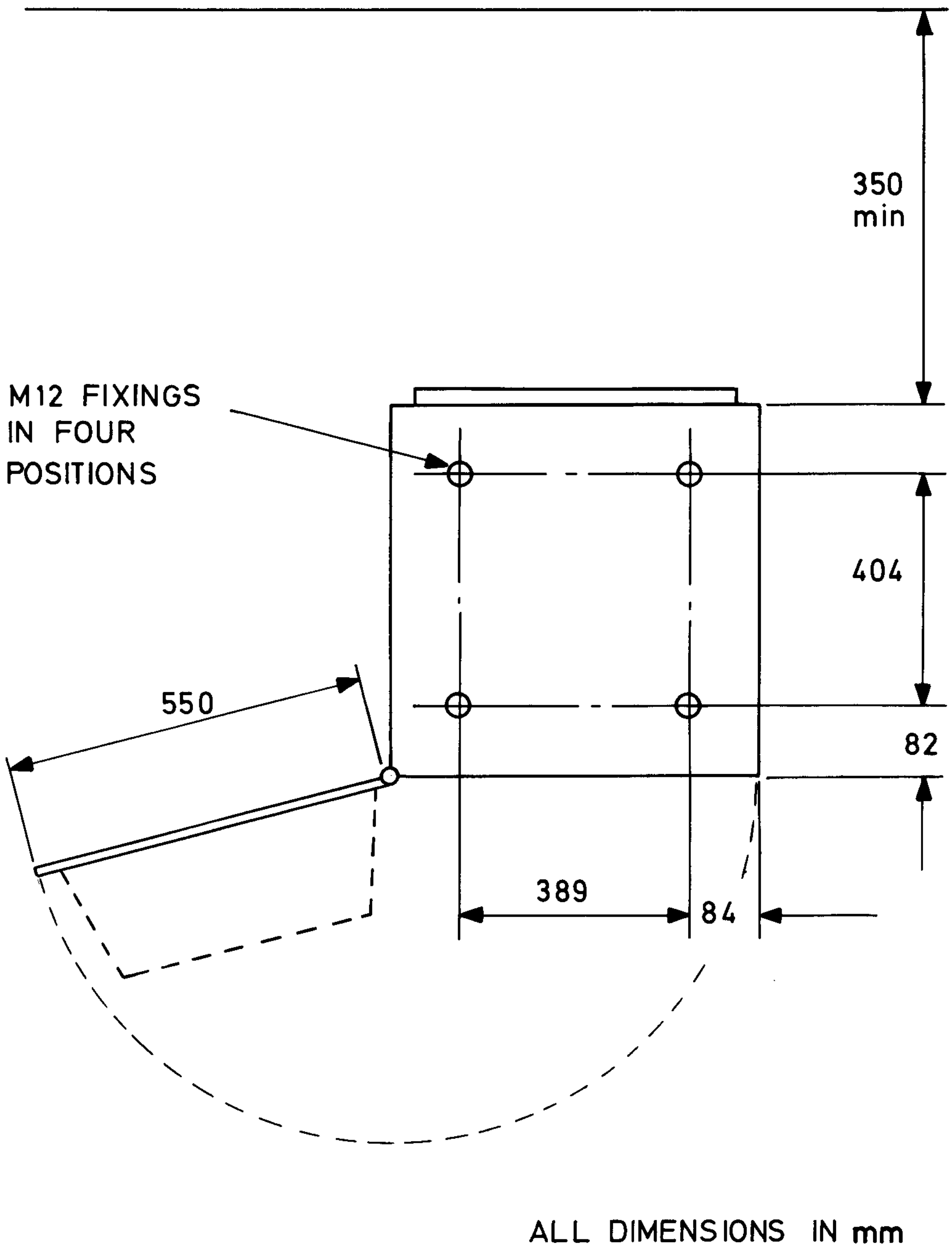
RF CONNECTORS

14. The antenna connection is made via the large coaxial connector at the top rear of the cabinet; the connector forms part of the VSWR unit.

15. The r.f. drive from a separately-located Exciter Unit enters via SK3. This coaxial connector is located immediately below the r.f. output connector.

Table 2: EXTENDED CONTROL LINES

TB10/	Description
1	Extended EHT-ON Select
2	Extended Reset
3	Extended Standby Select
4	Ext. EHT Lamp
5	Ext. STANDBY Lamp
6	Ext. READY Lamp
7	Ext. FAULT Lamp
8	+12 V, Interlock Output
9	Interlock Input
10	Extended MUTE
11	-12 V
12	0 V



Installation Dimensions and Clearances

Fig 2.1

CHAPTER 3

SETTING-UP AND OPERATION

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CHAPTER 3

SETTING-UP AND OPERATION

INTRODUCTION

1. This chapter describes the operating controls and indicators and gives the procedures for local and extended operation.

2. It is assumed that the Linear Amplifier has been installed in accordance with the instructions given in Chapter 2. For information on the associated units, e.g. the Racal MA 1723 Drive Unit, reference should be made to the relevant technical manual.

CONTROLS AND INDICATORS

3. The functions of the front panel controls and indicators are as follows:

(1) ON/OFF/EHT SHORTED switch. Controls all a.c. supply inputs to the Linear Amplifier. For safety reasons, the Cabinet Master switch incorporates a mechanical interlock; this prevents access to the power supplies or to the amplifier stages unless the EHT SHORTED position is selected.

(2) SUPPLY indicator: glows when a.c. power is switched on.

(3) STANDBY pushbutton (with locking action): function self-explanatory. With the STANDBY condition selected, all power supplies with the exception of EHT and PA screen supply are activated.

(4) STANDBY lamp: glows when STANDBY condition is selected.

(5) EHT pushbutton (with locking action): function self-explanatory.

(6) EHT lamp: glows when EHT voltage is present. If the EHT-ON condition is selected about three minutes after the selection of STANDBY, the EHT supply is connected to the Linear Amplifier; if selected earlier, the EHT lamp flashes until the valve warm-up period has elapsed at which time the EHT supply will be connected.

(7) CONTROL EXTENDED pushbutton (with locking action): transfers control of the STANDBY and EHT functions to an extended control location.

(8) CONTROL EXTENDED lamp: glows when extended control function has been selected.

(9) RESET pushbutton (non-locking): used to initiate the tune-up sequences.

(10) RESET lamp: glows under fault conditions.

(11) READY indicator: glows when tune-up has been completed and the Linear Amplifier is ready for 'traffic'.

(12) INTERLOCK - fault indicator: function self-explanatory.

(13) AIR FAILURE indicator: function self-explanatory.

(14) EHT OVERLOAD indicator: function self-explanatory.

(15) MISTUNED fault indicator: glows when insufficient r.f. power is generated during the tune-up sequence (Refer to Chapter 4, para 118).

(16) VSWR fault indicator: glows when the r.f. power reflected from the external load exceeds a predetermined level.

(17) MANUAL RANGE SELECTION switch (nine-position): function self-explanatory. This switch is normally left in the AUTO position.

(18) MANUAL ALC switch (two-position): controls the r.f. drive levels during a manual tuning sequence.

(19) METER and meter switch (twelve-position): functions self-explanatory.

LOCAL OPERATION - AUTO TUNING

4. (1) Check that the r.f. output from the Linear Amplifier is terminated into a suitable dummy load or antenna.

(2) Check that the RF compartment door is closed and secure.

(3) Check that the MANUAL RANGE SELECTION switch is set to AUTO and the MANUAL ALC switch is set to OPERATE. Check that the lower plate for these controls is closed and secure.

(4) Set the cabinet Master switch to EHT SHORT.

(5) Check that the four pushbuttons on the Control Unit are OFF (released).

(6) Switch ON the mains a.c. supply for the Linear Amplifier.

(7) Set the Master switch to ON (fully clockwise). Check that the SUPPLY indicator glows.

(8) Press the STANDBY pushbutton.

(9) Check that the STANDBY lamp glows.

(10) Set the meter switch on the Control Unit to +28 V and check that the +28 V supply rail is established.

(11) Press the EHT pushbutton.

(12) Check that the EHT lamp starts to flash at about 2 Hz rate.

(13) Allow about 3 minutes warm-up time, during which the EHT relay should operate. Check that the EHT indication changes to a steady glow.

(14) Set the meter switch to each of the positions listed in Table 1 and check that the relevant meter readings are obtained.

(15) Should the Ik (cathode current) reading exceed 300 mA carefully adjust the PA grid bias level using the preset control which is located below the MANUAL RANGE SELECTION switch. (Access to this preset control requires the removal of a cover plate).

5. (1) Set the associated Drive Unit to provide a tuning signal at the desired operating frequency.

(2) Set the meter switch to I/P PWR and check that the signal input level is about 100 mW. Adjust as necessary.

(3) Press the RESET pushbutton.

(4) The servos should come to rest within 10 seconds. Check that the READY indicator glows, and that there are no fault-indications.

(5) Set the meter switch to each of the positions listed in Table 2 and check that the relevant meter readings are obtained.

(6) If the READY condition does not occur within 10 seconds, the RESET lamp will glow. Check the condition of the fault-indicators and, if none are glowing, press the RESET pushbutton; this will initiate a second tune-up sequence.

6. To change the operating frequency, repeat operations 5(1) and 5(5) inclusive.

LOCAL OPERATION - MANUAL TUNING

7. (1) Check that the RF Compartment door is closed and secure.

(2) Remove the cover plate (at top left of the Linear Amplifier) to expose the MANUAL RANGE SELECTION and MANUAL ALC controls.

(3) Remove the cover plate at the bottom of the door, to expose the manual tuning controls.

(4) Carry out the switch-on procedures described in para 4(4) to para 4(14) inclusive.

(5) Set the MANUAL RANGE SELECTION switch to suit the frequency range in use.

(6) Set the MANUAL ALC switch to TUNE.

(7) Set the associated drive unit to provide a tuning signal at the desired operating frequency.

(8) Set the meter switch to I/P PWR and check that the signal input level is about 100 mW. Adjust as necessary.

(9) Set the meter switch to LOAD.

(10) Pre-tune the Loading coil to the low-frequency start position. For an operating frequency in the range 1.6 MHz to 13.47 MHz turn the left-hand LOAD control clockwise (left-to-right) until the meter indicates 42 (FSD = 50); for a frequency in the range 13.47 MHz to 30 MHz, adjust for a meter reading of about 20.

(11) Set the meter switch to TUNE.

(12) Pre-tune the Tune coil to the low-frequency start position. For an operative frequency in the range 1.6 MHz to 13.47 MHz, turn the right-hand TUNE control clockwise until the meter indicates 42; for a frequency in the range 13.47 MHz to 30 MHz, adjust for a meter reading of about 20.

(13) Set the meter switch to Ik. Check that the PA cathode current is not more than 400 mA.

(14) Set the meter switch to RF Va.

(15) Adjust the TUNE control anti-clockwise (right-to-left) until the meter reading rises to a peak at about 4.0 kV (FSD = 5 kV).

(16) Adjust the LOAD control clockwise until the meter reading falls to about 1.75 kV.

(17) Repeat operations 7(15) and 7(17) alternately until the meter reading is about 1.75 kV for both adjustments.

(18) Set the MANUAL ALC switch to OPERATE.

(19) Set the meter switch to Ik and check that the cathode current is between 650 mA and 680 mA.

(20) Set the meter switch to RF Va.

(21) Make final slight adjustments such that peak output occurs at a meter reading of 4.25 kV.

(22) Set the meter switch to FWD PWR and check for an r.f. output power in the range 800 W to 1200 W.

<u>EXTENDED OPERATION</u>

8. (1) Check that the r.f. output from the Linear Amplifier is terminated into a suitable dummy load or antenna.

(2) Check that the RF Compartment door is closed and secure.

(3) Check that the MANUAL RANGE SELECTION switch is set to AUTO.

(4) Check that the four pushbuttons on the Control Unit are OFF (released).

(5) Switch ON the main a.c. supply for the Linear Amplifier.

(6) Set the Master switch to ON (fully clockwise). Check that the SUPPLY indicator glows.

(7) Transfer control to the extended control position by pressing the CONTROL EXTENDED pushbutton. Check that the CONTROL EXTENDED lamp glows.

TABLE 1 METER READINGS, NO DRIVE

Switch Setting	Typical Reading	Meter FSD
EHT	2.9 kV	5 kV
Ik	300 mA	1 A
Vg2	225 V	500 V
Ig2	-	50 mA
+28	28 V	50 V
RF Va	~~4.0 kV~~	5 kV
FWD PWR	-	1500 W
REF PWR	-	400 W
I/P PWR	100 mW	400 mW
LOAD	-	50
TUNE	-	50

TABLE 2 METER READINGS, TUNING COMPLETED

Switch Setting	Typical Reading	Meter FSD
EHT	2.9 kV	5 kV
Ik	650 mA to 680 mA	1 A
Vg2	225 V	500 V
Ig2	-10 mA to zero	50 mA
+28	28 V	50 V
RF Va	4.2 kV	5 kV
FWD PWR	800 W to 1200 W	1500 W
REF PWR	*	400 W
I/P PWR	100 mW	500 mW
LOAD	-	50
TUNE	-	50

*Reading depends upon external load impedance, but will not exceed 300 W.

CHAPTER 4

CIRCUIT DESCRIPTION - CONTROL UNIT

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CHAPTER 4

CIRCUIT DESCRIPTION - CONTROL UNIT

INTRODUCTION

1. The logic circuits in the Control Unit are concerned with three main activities viz switching-on, change of operating frequency and control of power output levels, each of which is described in turn.

2. Most of the logic circuits are carried on six cards (printed-circuit boards) which plug into, and are interconnected by, a motherboard assembly. The remainder are carried on the front panel.

3. There is considerable interdependence between the logic circuits. Additionally, for ease of manufacture, some logic elements have been located on cards other than those directly associated with the particular circuit function. In order to present the switch-on, tuning, and other sequences in their proper order it is necessary to 'follow' the control signals from card to card; this entails periodic reference to the motherboard circuits and, in some cases, to those for the power supplies and r.f. amplifier.

SWITCHING-ON

4. The front panel must be closed and secured before switch-on be attempted. Then the Master-switch for the cabinet is moved from EHT-SAFE to OFF and finally to ON (fully clockwise).

Master-Switch ON

5. Setting the Master-switch (S1) to ON connects the main a.c. supply to the primary of the auxiliary-supply transformer T3. This results in the establishment of the motor supplies, the +12 V and -12 V stabilized supplies, ~~and of the 28 V supply for the Drive Amplifier~~. The POWER indicator glows, to confirm this condition.

6. On the Switch-on Sequence Card (Fig. 8), the presence of a +12 V supply results in logic 1 Power-up-Reset signals via networks R17, C7 and R23, C15. The Q outputs of ML5, ML6a, ML6b and ML6c all go to logic 0. Capacitor C16 starts to charge via R25, giving a logic 1 which enables ML2c.

7. Assuming that the CONTROL EXTENDED pushbutton is OFF (released), the +12 V level at board pin 11 causes the B-to-D paths of ML13 to be selected and the A-to-D paths to be disabled.

Standby Selected

8. Pressing the STANDBY pushbutton produces a logic 0 Standby-Selected signal at pin 13 of ML13. This level, inverted by ML4b switches-on relay driver TR1. Provided that the interlock circuit is complete, a 0 V level via board pin 34 causes the Standby Relay (RLB in Fig. 47) to be energized.

9. Relay contacts RLB1 close to connect the main a.c. supply to transformer T3 and to the air blower BL1. The heater and grid bias supplies for the PA valve are switched-on, and the air blower is started.

10. When the blower motor reaches operational speed, the airflow switch (S4) closes; this gives a 0 V level at board pin 16 of the switch-on sequence card.

11. The establishment of the grid bias supply results in a -51 V level at board pin 14. The junction R1, R2, R6 goes to 0 V giving a logic 0 input to ML8a and to ML7d. ML7d output goes to logic 1, switching-'on' lamp-drivers ML12a and ML12b; the STANDBY indicator glows (this gives visual confirmation of the Standby condition and of Bias-Present).

12. The same logic 0 from ML13 starts the EHT-delay timer, formed by free-running astable ML9 and binary counter ML5. It also removes the reset from latches ML6a and ML6b.

13. ML5 starts to count the squarewave signals from ML9, which are repetitive at about 40 Hz rate. Successive counts-of-32 cause the Q5 output of ML5 to be logic 1, logic 0, logic 1, logic 0 etc. Thus a squarewave signal is fed via ML3a, ML7f to ML10b, causing lamp drivers ML11e, ML11f to be switched-on and off at about 2 Hz rate. The EHT lamp flashes at this rate, indicating 'warm-up in progress'.

Airflow Satisfactory

14. When the count reaches 2048, the Q11 output of ML5 goes to logic 1 and in turn sets the Q output of ML6a to logic 1. Provided that the air blower is operating correctly, the 0 V signal via board pin 16 holds C16 discharged and hence ML2c output remains at logic 0.

15. Should the airflow from the blower be inadequate, C16 will remain charged giving a logic 1 level at pins 11 and 12 of ML2c. ML2c output will go to logic and this Air-Fail signal will effect three operations:

    (1) ML4b output will go to logic 0, TR1 will be switched-off and the standby relay will be released.

    (2) ML11f output will go to logic 0, activating the AIR-FAIL indicator.

    (3) The logic 1 via ML3b, ML3c will signal a fault to the Servo Control Card.

EHT-ON Selected

16. The EHT pushbutton can be operated at any time during the warm-up period, but the EHT-ON function will not be achieved until the warm-up period has elapsed and the relevant criteria have been satisfied.

17. Pressing the EHT pushbutton produces a logic 0 EHT-Selected signal at pin 12 of ML13; this level removes the reset from latch ML6c. The EHT-Selected and Standby-Selected signals together produce a logic 1 from ML4a which enables ML2b. ML7c output goes to logic 0.

Warm-Up Completed

18. When the count by ML5 reaches 16384 (this takes about 3 minutes), the Q14 output of ML5 goes to logic 1 and in turn sets the Q output of ML6b to logic 1.

19. The logic 1 from ML6b produces a logic 1 from ML2b to ML2a (and to ML8b). With latch ML6c reset, ML7e and ML7f outputs are at logic 1; with Bias-Present, pin 1 of ML2 is at logic 1. All inputs being at logic 1, ML2a output goes to logic 1. TR1 is switched 'on' causing the EHT relay (RLA in Fig. 47) to be energized. Relay contacts RLA1 close to connect the main a.c. supply to transformer T1.

20. The same logic 1 from ML6b via ML3a, ML7f forces ML10b output to logic 0. This causes the EHT lamp to be extinguished temporarily.

21. The EHT supply for the PA valve is established, and this condition is signalled by a +11 V level at board pin 15. ML10b output goes to logic 1 and switches ML11e, ML11f 'on' again. The EHT lamp glows (this gives visual confirmation of 'Warm-up Completed').

22. At this stage, the SUPPLY indicator and the STANDBY and EHT lamps should be 'on', and none of the fault indicators. Tuning has not yet been effected, so the READY indicator is 'off'.

AUTO-TUNING SEQUENCES

23. The complete tuning sequence is initiated by means of the RESET pushbutton.

24. When the RESET pushbutton is pressed momentarily, a short logic 1 pulse is developed at pin 11 of ML13 on the Switch-On Sequence Card (Fig. 8). This pulse triggers monostable ML1, to produce a logic 1 pulse of about 50 ms duration.

25. The leading edge of the pulse sets the Q output of latch ML6d to logic 1. This level produces via ML10c, ML11d a logic 0 Mute signal for the drive amplifier stages (Chapter 5). The pulse from ML1 is also fed via ML10a to provide the Reset signal for the Counter, Thyristor Decoder, ALC and Servo Control cards.

Coarse-Tune-Initiate

26 The logic 1 Reset pulse from the switch-on sequence card is the Coarse-Tune instruction. This signal, via pin 3 on the Counter Card (Fig. 10), causes ML5b output to be pulsed to logic 1 and in turn reset binary counters ML1, ML9 and latch ML4a; their Q outputs all go to logic 0. ML6c output goes to logic 1, and this level enables ML6a and ML6d.

27. A logic 1 signifying Not-Ready is present at pin 2 of ML5. The 1.28 MHz crystal oscillator - formed by ML5a and associated components - starts to run, giving clock pulses via ML6a.

28. The tuning-signal input from the drive unit, at the 'new' operating frequency, is applied to the squarer stage TR1 to TR4 and thence via TTL buffers ML7a, ML7b to divide-by-sixteen stage ML1.

29. The resultant pulse train, at one-sixteenth of the input rate, is fed via the TTL-to-CMOS level converter (ML3) to ML6d and thence to the Thyristor Decoder Card.

30. The first of these pulses sets latch ML4a. Its Q output goes to logic 1 and this level enables ML6b. ML9 starts to count the 1.28 MHz clock pulses from ML5a.

31. When the count reaches 16384 (this takes about 78 ms), the Q14 output of ML9 goes to logic 1. ML5c output goes to logic 0 and this level disables ML6a and ML6d; the count is halted, and the output via pin 2 to the Thyristor Decoder Card ceases.

Frequency-Range Counter

32. On the Thyristor Decoder Card (Fig. 12), the gated pulse train representing the desired operating frequency is clocked into Binary counter ML3.

33. The 'clock' input for ML3 is the operating frequency divided by 16, and this input is present for a 78 ms (nominal) period.

34. At the lowest operating frequency, 1600 kHz, the clock frequency is 100 kHz. 1280 pulses enter ML3 during the gating period; this number results in logic 1 outputs at pins 13 and 14, and hence a logic 1 output from ML6a. This signal sets latch 'a' in ML1, giving a logic 1 at the Q1 output.

35. According to the actual operating frequency, a discrete number of pulses will enter ML3 during the gating period and will cause one or more of the Q outputs to go to logic 1.

TABLE 1

THYRISTOR OUTPUTS VS FREQUENCY BANDS

	FREQUENCY BAND							
	1	2	3	4	5	6	7	8
SCR NO.								
1		X	X					
2			X		X			
3					X		X	X
4				X	X		X	X
5						X	X	X
6								X
7	X	X		X			X	
8		X						X
9			X	X	X			
10	X	X						
11	X	X	X	X				

36. When the 'count' for the particular frequency has been completed, one or more of the latches in ML1, ML12 will have been set and the relevant Q outputs will be at logic 1.

Range Identified

37. The Q1 to Q4 outputs from ML1 and ML12 are decoded, by an array of exclusive-OR gates, to provide logic 1 Frequency-Range signals (at board pins 4 to 11). Starting with the Q1 output from ML1, the Q outputs are arranged in ascending order of operating frequency; the frequency ranges are identified in reverse order.

38. The same Q outputs are decoded by ML13d and ML13c, ML11c to produce, via TR1 to TR3, the Filter-Select signals for the PA grid networks.

Select Fixed Capacitors

39. The discrete values of capacitance required by the PA tuning and output-loading circuits are built up from a range of fixed values (Chapter 6), and are selected in accordance with the frequency-range information.

40. The fixed capacitors are switched into circuit by means of a.c.-operated solenoids. The control signals for the solenoids are derived from the Frequency-Range signals via an array of OR gates (ML4, ML10, ML11, etc.) Table 1 summarises the requirements for each of the eight ranges.

41. A particular solenoid is energized when its associated silicon-controlled-rectifier (SCR) is activated by a logic 1 gate-signal.

42. The solenoids are powered from a 115 V sinewave supply. The SCR conducts only on the positive-going half-cycles. Protection against inductive surges during the SCR-off periods is provided by an array of diodes, which are carried on the Manual Override board.

Set LF Tuning Point

43. On the Counter Card, a discrete logic 1 corresponding to the desired frequency-range is presented to the relevant D input of ML11. This signal is decoded by ML11, to produce a 3-line binary-coded output (pins 6, 7 and 9).

44. The particular binary code is passed to multiplexers ML8 and ML10 and, via board pins 23 to 25, to the Servo Control Card.

45. The multiplexers operate in the manner of single-pole, multi-way switches. According to the settings on the A, B and C control lines, ML8 connects the common line (pin 3) to one of eight resistors (R7 to R17). The potential divider formed by R4 in conjunction with the selected resistor sets the coarse-tuning reference potential for the servo system.

46. In a similar manner, ML10 sets the reference potential for the loading servo.

47. The two reference voltages, in the range +7.5 V to -7.5 V, are passed to the Servo Preamp Card.

Start Servo Timer

48. Coincident with the Coarse-Tune signal to the Counter Card (para 26), a logic 1 Reset pulse was applied to the Servo Control Card (Fig. 14).

49. The leading edge of this logic 1 pulse via board pin 3 sets the Q output of latch ML8b to logic 1. ML4c output goes to logic 0 to provide a Mute signal for the drive amplifier (Chapter 5).

50. The trailing edge of the same pulse triggers monostable ML5a; its Q output goes to logic 1. After a short time-delay, the Q output of ML5a reverts to logic 1; this transition triggers monostable ML5b.

51. The Q output of ML5b goes to logic 1, and this level sets the Q outputs of ML8d and ML8a to logic 1. The $\overline{Q}$ output of ML5b goes to logic 0, and this level triggers the servo timer ML7.

52. The Q output of ML7 goes to logic 1, giving a Timer-Running signal to ML6b and ML9d. The same logic 1 via D12 activates relays RLA and RLB on the Servo Preamp Card.

53. After a short time-delay, the Q and $\overline{Q}$ outputs of ML5b revert to their former states.

54. The logic 1 from ML8d provides a Control B (Coarse-Tune) instruction, via board pin 19, to the Servo Preamp Card; ML1b output goes to logic 0, activating the COARSE-TUNE indicator. The same logic 1 produces a logic 0 at pin 1 of ML11.

55. The logic 1 from ML8a produces a logic 0 from ML2b and a logic 0 at pin 2 of ML11. ML11a output goes to logic 0 and, after about 1 s delay, ML4a output goes to logic 0.

56. The logic 0 from ML11c forces the outputs of ML10b, ML10c and ML10d to logic 0. These outputs are the gain-control signals for the tune-coil servo system; the all-zeros condition corresponds to maximum sensitivity.

Enable Servo Power Amplifiers

57. On the Servo Preamp Card (Fig. 16), a 0 V level (corresponding to the AUTO setting of the MANUAL RANGE SELECTION switch) is present at board pin 12. A +12 V (nominal) level from the servo timer is present at board pin 13. Relays RLA and RLB are energized; their respective contacts close to interconnect the servo preamplifiers with the servo power amplifier stages.

Tune to Reference Positions

58. The logic 1 Coarse-Tune instruction via board pin 19 sets multiplexer ML4 to accept the coarse-tuning reference signal at board pin 15 and the tune-coil-position signal via board pin 2, and to present them to the inputs of the comparator ML5a.

59. If it is assumed that the new operating frequency is lower than the previous one, an increase in tune-coil inductance will be required in order to reach the coarse-tune reference setting; the potential at pin 3 of ML5 will be positive with respect to that at pin 2.

60. ML5a output goes towards +12 V, forcing ML5b output to be positive-going. The control signal via board pin 6 activates TR5 and TR1 in the servo power amplifier (Fig. 43).

61. The tune servo motor is switched-on with appropriate polarity of supply, and starts to drive the slider of the tune-coil towards the desired position.

62. A d.c. voltage corresponding to the number of turns in-use is provided by the associated tune-coil potentiometer and is presented at board pin 2; the same d.c. level, via ML5c, provides a visual indication on the meter.

63. As the coarse-tuning adjustment is made, the potential at board pin 2 is varied appropriately. When this potential equals that at board pin 15, ML5a output becomes zero; ML5b output reverts to zero and hence the servo motor is switched-off.

64. The tune-coil is now set to its reference position, in readiness for the ramp-tuning sequence.

65. The same logic 1 at board pin 19 causes multiplexer ML1 to accept the loading reference signal at board pin 14 and the loading-coil potentiometer signal at board pin 3.

66. In the manner described above, the load-servo motor is activated and the wiper of the load-coil is set to its reference position.

Servo-Running Detector

67. Each time that either of the servo motors is switched-on, and for the period that it is running, a supervisory signal is sent to the Servo Control Card.

68. The voltages at pin 7 of ML5 and at pin 8 of ML3 are monitored by comparators ML6a, ML6b and ML6c, ML6d respectively. Any significant departure from a 0 V level at either point results in a logic 1 Servo-Running signal at board pin 16. (The +2 V and -2 V threshold levels are set by network R45, R46, R49 and R50.)

Coarse-Tune-Completed

69. When both servo motors have come to rest, the level at board pin 16 reverts to 0 V. ML4d output goes to logic 1. (ML2b is unaffected, because its output is already held at logic 0.)

70. Provided that the PA stage is warmed-up and 'waiting', a logic 1 EHT-Available signal is present at board pin 24.

71. ML6a output goes to logic 1, resetting the Q output of ML8d to logic ~~1~~.0. The Control B signal is cancelled and the COARSE-TUNE indicator is extinguished.

Ramp-Initiate

72. The logic 0 from ML8d forces ML11b output to logic 1. The rising edge from ML11b via C10 resets the Q output of ML8b to logic 0. ML4c output goes to logic 1, de-muting the drive amplifier stages.

73. The logic 1 from ML11b sets ML11a output to logic 1. ML1c output goes to logic 0, activating the RAMP indicator.

74. The logic 1 via board pin 17 provides a Ramp-Tune instruction for the Tune servo system, and the logic 1 from ML4a via board pin 18 provides a Hold signal for the load-servo.

75. On the Servo Preamp Card, the level at board pin 19 goes to logic 0 and then a logic 1 is presented via board pin 17. This causes ML4 to change settings such that the tune-coil position signal (board pin 2) and a -6 V reference voltage are presented to ML5a.

76. The resultant negative-going output from ML5b is a 'Tune-towards-30 MHz' instruction. This causes the tune servo motor to be activated for this direction of travel.

77. The changes in control levels at board pins 17, 18 and 19 do not affect the signal inputs to ML3b. At this stage, the load-servo system is at rest and it is held in this condition whilst ramping takes place.

Set RF Tune Level

78. When the grid drive is applied, the PA cathode current rises from its quiescent value. This increase is monitored on the ALC Card, and the level of grid drive is adjusted such that the valve now operates under the predetermined 'Tune' conditions.

Anode-Voltage-Detected

79. The servo system causes the inductance of the tune-coil to be reduced progressively, and the desired resonance point is approached from the low-frequency side.

80. The r.f. signals developed at the PA valve diode are monitored (by a detector circuit in the PA compartment) to produce a negative-going d.c. potential proportional to the r.f. level. This steadily-increasing d.c. potential is presented at pin 10 of the ALC Card.
Servo Preamp

81. When the level at board pin 10 exceeds the threshold set by R60, R61, comparator ML3d produces a logic 1 Anode-Voltage-Detected signal (board pin 23).

Ramp-Completed

82. On the Servo Control card, the logic 1 via board pin 23 and the logic 1 from ML11b together produce a logic 1 from ML10b. This level resets latch ML8a, and its Q output goes to logic 0.

83. The logic 0 from ML8a forces ML11c output to logic 1. This level enables gates ML10b, ML10c and ML10d allowing the gain-control signals from the Counter card to be routed to the servo preamplifiers.

84. The logic 0 from ML11c forces ML11a output to logic 0. The Control A signal is cancelled and the RAMP indicator is extinguished.

85. After about 1 s delay (network R14, C12) ML4a output goes to logic 0. The Control A′ signal is cancelled.

86. The control signals via board pins 17, 18 and 19 are all at logic 0. This constitutes the Fine-Tune instruction for the Servo Preamp Card. ML2a output goes to logic 1; ML1a output goes to logic 0, activating the FINE-TUNE indicator.

Select Fine-Tune Discriminator

87. On the Servo Preamp Card, the logic 0 levels at board pins 17 and 19 cause ML4 to change settings and to select the anode phase discriminator output via board pins 4 and 5.

88. Using the 0 V reference level at pin 1 of ML4, the tune servo system adjusts the PA anode circuit to resonance. This produces a Servo-Running signal via board pin 16.

89. ML1 remains at its previous settings, with the load-servo motor 'off', until the level at board pin 18 goes to 0 V (para 85). Then ML1 changes settings, to select the load-discriminator input via board pins 10 and 11.

90. Using the 0 V reference level at pin 1 of ML1, the load-servo system adjusts the Load coil such that the desired load impedance is presented to the PA valve.

91. The fine-tuning and loading requirements are somewhat interdependent. When both servo systems have reached their optimum settings, the servo motors are switched-off and the Servo-Running signal is cancelled.

Fine-Tune-Completed

92. On the Servo Control card, both inputs to ML2b are now at logic 0; its output goes to logic 1, signifying Fine-Tune-Completed.

93. Provided that the entire tuning and loading procedure has been completed within the 10 second period defined by timer ML7, a logic 1 is present at pin 6 of ML6b. The resultant logic 1 from ML6b sets the Q output of ML8c to logic 1, giving a Ready signal at pin 13 of ML6.

94. ML4f output goes to logic 0, and this level resets the servo timer; the Q output of ML7 reverts to logic 0.

95. The +12 V output via board pin 13 is cancelled, causing relays RLA and RLB to be released. The paths between the Servo Preamplifiers and Servo Power Amplifiers are broken and hence the servo systems are disabled.

Ready

96. The logic 1 from ML8c via ML2c, ML9a, ML4e produces a logic 1 No-Fault signal at pin 12 of ML6. The resultant logic 1 from ML6d and the logic 1 EHT-Available signal together produce a logic 1 from ML6c. This level is

routed via multiplexer ML3 to produce logic 0 outputs from ML1d and ML1e. The READY indicator, glows, to confirm 'Tuning Completed'.

97. If the tuning sequences have not been completed within the 10 second period defined by ML7, the Q output of ML8c will still be at logic 0 after the Timer-Running signal is cancelled.

98. With both inputs to ML2c at logic 0, its output goes to logic 1. This level via ML9a produces a logic 0 Fault output from ML1f.

99. The same logic 1 from ML2c via ML9a, ML4e holds ML6d output at logic 0. This level forces ML6c output to logic 0, and in turn inhibits the Ready signal outputs via board pins 4, 5 and 6.

100. A logic 0 Fault output (for external use) is also produced by a logic 1 signal at either board pin 8, 9 or 10. The signal routeing is self-explanatory.

CONTROL OF RF DRIVE LEVELS

101. Control of the grid drive level to the PA stage, and protection against over-drive conditions, is effected on the ALC Card (Fig. 18).

102. Three quantities - the PA cathode current, PA screen current and the anode r.f. voltage - are monitored by circuits on the board and control signals are generated which effect appropriate gain-reductions in the drive amplifier (Chapter 5).

Cathode Current Monitor

103. The Ik monitor circuit provides a negative-going voltage which is proportional to the PA cathode current. This d.c. level, at a rate of -1 V per 200 mA, is presented at board pin 17 and is passed via opto-coupler ML1. Thus the voltage developed across R4 is a measure of the PA cathode current.

104. Under no-drive conditions, the cathode current is about 300 mA. The precise level is set by means of the grid-bias control (R1 in Fig. 47).

Tune-Levels

105. When r.f. drive is applied during ramping, and again during fine-tuning, there is a rapid increase in cathode current. When the magnitude of the voltage across R4 exceeds the threshold level set by network R32, R36 (corresponding to Ik = 400 mA), the tune-level comparator ML2c provides a positive-going output via D13 to TR5 base.

106. TR5 emitter follows the rise in voltage across R42, and the charge in C12 is increased accordingly. This causes an increased conduction by the Darlington pair TR7, TR8.

107. The rise in the ALC control voltage via Board pin 12 results in increased conduction by PIN diodes D1 and D2 on the Drive Amplifier board (Chapter 5).

108. The resultant attenuation of the r.f. input to the wide-band amplifier stages reduces the level of the PA grid drive. The PA cathode current falls slightly, ML2c output level falls proportionally and then the ALC system reaches equilibrium.

ALC Time-Constants

109. During the tune-up period, a logic 1 Not-Ready signal is present at board pin 25. TR4 is switched-'on', causing TR3 to be off.

110. The same logic 1 switches TR6 'on', to give a short decay time-constant for the ALC loop. The attack-time is determined by R44, C12 and the effective resistance of TR5.

111. On completion of the fine-tuning sequence, the level at board pin 25 goes to logic 0. TR6 is switched-off, open-circuiting R45. This changes the decay-time of the ALC loop to that determined by R48, C12.

112. The logic 0 Ready signal also switches TR4 'off', allowing TR3 to conduct. The junction R40, D13 is pulled 'down' below the ALC threshold level set by R38. With D13 reverse-biased, the control signals from ML2c are disabled.

Operate-Levels

113. When the 'traffic' signals are applied via the drive amplifier, the cathode current rises proportionally. When the instantaneous value exceeds the threshold level set by network R30, R31, R34 (this corresponds to Ik = 680 mA), the operate-level comparator ML2d provides a positive-going output via D12.

114. In the manner described above, the control signal from ML2d effects a gain-reduction within the drive amplifier and in turn holds the PA cathode current to the desired value.

RF Anode Voltage Excessive

115. The r.f. signal level at the PA anode is monitored (Chapter 6) and a negative-going voltage proportional to this level is presented via board pin 6 to unity-gain stage ML3b.

116. Should the external loading be such that a higher-than normal impedance is presented to the PA valve, the output voltage developed by ML3b will exceed the threshold set by R15. This will produce a positive-going output from ML3c to the ALC control stage TR5, resulting in a gain-reduction action as described above.

Excessive Screen Current

117. The PA screen current is monitored and a voltage proportional to this level is presented via board pin 11. Should the screen current exceed +50 mA, comparator ML3d will produce a positive-going signal via D7. This will effect the appropriate gain-reduction action and in turn hold the PA screen current to the desired value.

Transmitter Mistuned

118. The forward-power indication from the VSWR unit (Chapter 8) and the cathode current input together provide a Transmitter Mistuned indication. Mistuning is defined as 'less than 300 W r.f. output for more than 580 mA cathode current'.

119. Comparator ML2a provides a positive-going output whenever the cathode current rises above 580 mA; the threshold is set by network R5, R9.

120. Comparator ML2b provides a positive-going output when the forward-power level exceeds 300 W. The comparator threshold is set by R10, R11 in conjunction with preset control R6.

121. Under normal conditions, the r.f. output level reaches 300 W before the cathode current has risen to 580 mA; ML2a output is close to 0 V. When the 'mistuned' latch (ML4a) is 'clocked' by ML2b output, its Q output remains at logic 0.

122. If the desired tuning conditions are not satisifed, ML2a output will be at logic 1 when the latch is clocked. The Q output of ML4a goes to logic 1, giving a Mistuned output via board pin 14. TR1 is switched on, activating the MISTUNED indicator and (via D17) the RESET lamp.

Excessive VSWR

123. Under normal conditions, the reflected-power indication, from the VSWR unit, has no effect upon latch ML4b.

124. Should a mismatch occur, the reflected-power level will rise significantly. If the magnitude of the signal via board pin 21 exceeds the threshold set by network R12, R13, ML3a output will be positive-going; this level 'clocks' ML4b. The Q output of ML4b goes to logic 1, giving a VSWR-Fault signal via board pin 15. TR2 is switched-on, activating the VSWR indicator and (via D17) the RESET lamp.

CHAPTER 5

CIRCUIT DESCRIPTION - DRIVE AMPLIFIER

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CHAPTER 5

CIRCUIT DESCRIPTION - DRIVE AMPLIFIER

INTRODUCTION

1. The drive amplifier accepts an r.f. input in the range 1.6 MHz to 30 MHz and provides an amplified output, at a level of 25 W, into 50 ohms impedance. The complete circuit diagram is given in Fig. 23.

2. The complete amplifier consists of three push-pull stages in cascade, and these are preceded by an input attenuator. All three amplifier stages operate in Class A; together they provide an overall power gain of about 30 dB.

INPUT ATTENUATOR

3. The input circuit for the first amplifier stage contains a voltage-controlled attenuator which provides the means of automatic level control (ALC) for the complete linear amplifier.

4. The attenuator is formed by R8, R10, R22 and R23 in conjunction with PIN diodes D1 and D2. The configuration of the attenuator is evident from Fig. 5.1, where the diodes are represented by a variable shunt element. The input and output terminations are provided by T8 and the base-emitter impedances of TR2 and TR6.

5. The conduction of D1 and D2, and hence the effective shunt resistance, is determined by the control signal at board pin 5. This signal is provided by a current source on the ALC Card (Fig. 18); the mean potential at pin 4 is about +4.5 V.

6. The method of gain control using the ALC loop is described in Chapter 4.

RF AMPLIFIER STAGES

7. The first amplifier stage (TR2, TR6) operates in the grounded-base mode. The intermediate and final amplifier stages (TR1, TR5 and TR3, TR4) use the common emitter configuration, and incorporate negative-feedback networks for frequency compensation purposes.

8. Inter-stage coupling is via pairs of step-down transformers (T4, T10 and T3, T9). Additional matching - between T3, T9 and the very-low input impedances of TR3 and TR4 - is provided by parallel-connected auto-transformers T1, T2 and T11, T12.

9. The final output via T5 provides a 50 ohm (nominal) signal source at SK1.

POWER SUPPLY RAILS

10. The complete amplifier is powered from the +28 V stabilized supply (Chapter 7).

11. Base-bias voltages for the individual amplifier stages are obtained from three stabilizer circuits which are carried on the drive amplifier board. These bias rails can be switched-on and off by means of an external signal, and thus provides the muting facility for the complete linear amplifier.

BIAS SUPPLIES

12. TR13 is conducting, base current being drawn via R49. The potential developed across R46 switches TR12 on, to produce a +27.5 V (nominal) supply across R44.

13. TR13 base potential is about +7 V and D5 cathode potential is about +12 V; D5 is reverse-biased so the muting input (board pin 4) is effectively open-circuit.

14. TR11 conducts, drawing base current via R41. The resultant +5.6 V level across R43 provides the base bias rail for the grounded-base stage TR2 and TR6.

15. TR8 conducts, drawing base current via R40. A proportion of the voltage developed across C30 is applied to TR9 base. TR9 conducts and in doing so reduces the drive available to TR8. The voltage across C30 falls slightly and then equilibrium is reached. The final voltage across C30, as set by R36, provides the base bias rail for intermediate stage TR1 and TR5.

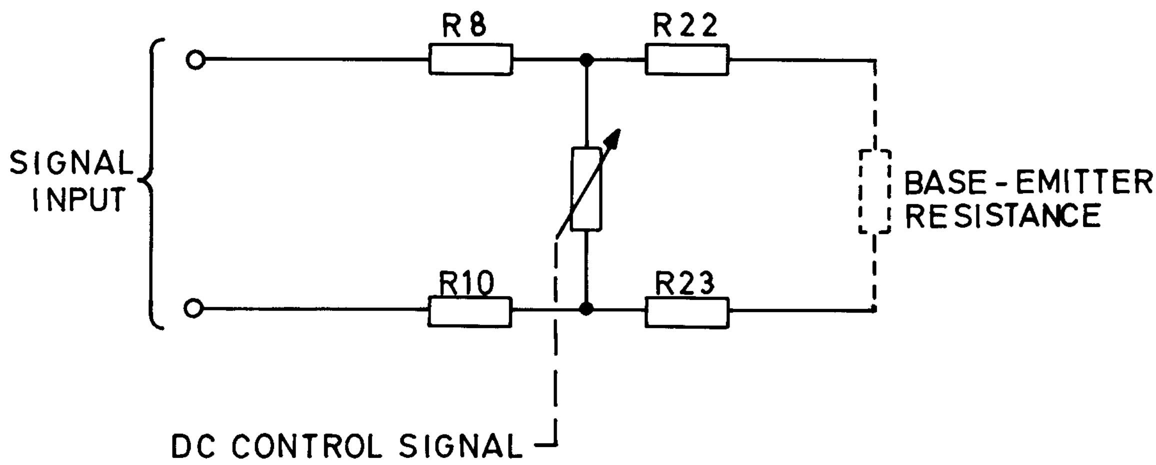
16. In a similar manner, the regulator formed by TR7, TR10 and associated components provides the base bias rail for the output stage TR3 and TR4.

17. A degree of temperature-compensation is provided by TR9 and TR10. These transistors are in thermal contact with the main heatsink. As the mean temperature rises, their conduction tends to increase and in turn reduce the base potential of their associated transistors (TR7 or TR8 as appropriate).

MUTING

18. When a 0 V muting signal (from the switch-on sequence board) is applied to board pin 4, TR13 is switched-off causing TR12 to cease conduction. This removes the supply voltage across R44 and hence the conduction of TR7, TR10, TR8, TR9 and TR11 ceases. The base bias voltages collapse and this mutes all three amplifier stages.

19. The +28 V rail remains 'on'. When the muting signal is removed, normal operating conditions are resumed.



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Simplified Circuit: Input Attenuator

Fig. 5.1

CHAPTER 6

CIRCUIT DESCRIPTION - RF POWER AMPLIFIER

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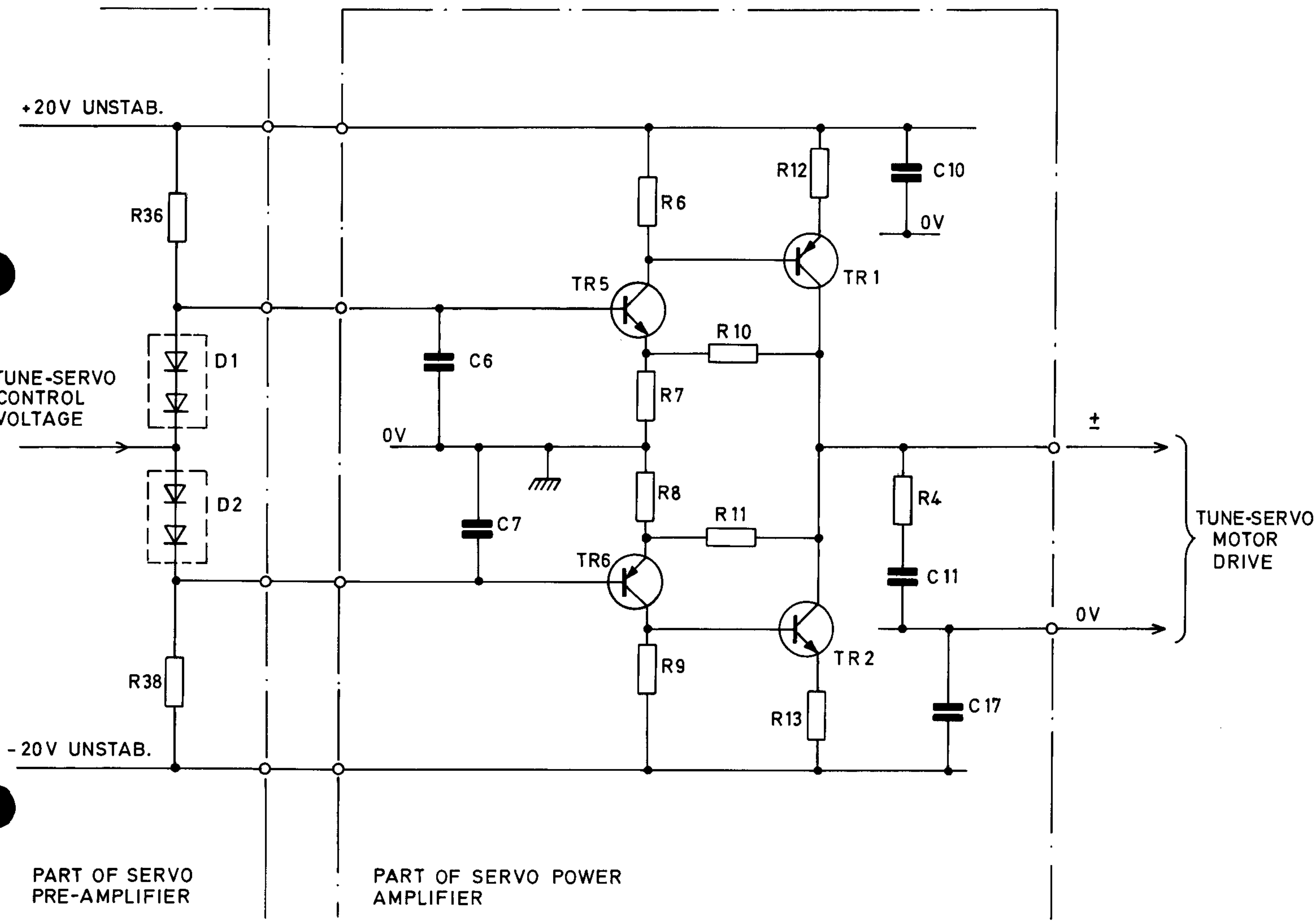
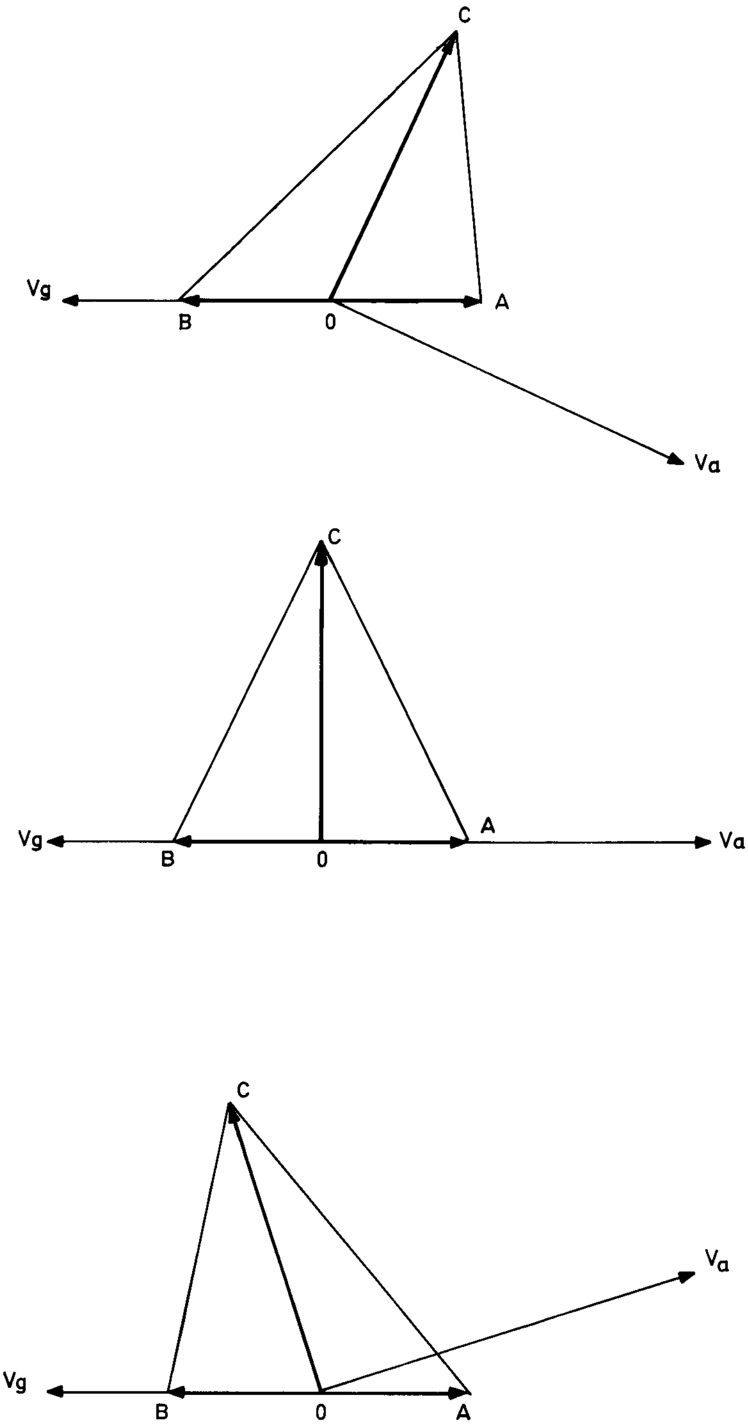


Simplified Circuit: Servo Power Amplifier Fig.6.2



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Vector Diagram, Anode Phase Discriminator Fig.6.1

CHAPTER 6

CIRCUIT DESCRIPTION - RF POWER AMPLIFIER

INTRODUCTION

1. The RF Power Amplifier (Fig. 30) consists of a single ceramic tetrode valve of 1500 W anode dissipation rating and an associated output network of PI-L format. The valve is operated in Class AB1, and has switched input matching networks.

INPUT MATCHING

2. According to the frequency-range information from the Thyristor/Decoder board (Chapter 4) either relay RLA, RLB or RLC is energized on the Input Matching board.

3. The output from the Drive Amplifier is routed via input matching networks to the grid of the valve. These comprise a step-up auto transformer with either a low-pass filter (for frequencies in the range 1.6 MHz to 9 MHz) or band-pass filters (9 to 20 MHz, 20 to 30 MHz) as appropriate. The output from the matching networks is at the 100 ohms impedance level.

INPUT TERMINATION

4. The grid drive signal is terminated into a composite 100 ohm load consisting of R6 and R7 (in parallel) in series with the effective resistance across T4 (T4 is a 1:1 ratio component).

GRID SIGNAL SAMPLE

5. A sample of the voltage across T4 is rectified and smoothed to provide a positive-going reference signal for the load-discriminator circuit on Servo Preamp card (Chapter 4).

ANODE OUTPUT

6. The amplified r.f. signal at the valve anode is amplified across the input capacitor of the PI-L network. In a manner described elsewhere, the r.f. signal is transformed into the correct signal level at the antenna.

TUNING AND LOADING NETWORK

7. The actual values of the 'tune' and 'load' capacitances of the output network are preselected according to the frequency range information from the Thyristor Decoder Card (Chapter 4) or, in the manual tuning mode, by control signals from the MANUAL RANGE SELECTION switch.

8. The output circuits are brought to resonance by means of the variable inductors L4 and L5. The actual values of inductance in use for a particular operating frequency as set by means of the tuning and loading servo motors (para. 23).

Coil Taps

9. The Linear Amplifier operates over the range 1.6 MHz to 30 MHz, and this range is covered by a single Tune coil and a single Load coil. At certain operating frequencies, the portions of these coils not-in-circuit can give rise to spurious resonance effects and hence excessive circuit losses. To prevent these effects, metal fingers short circuit sections of the coils whilst operating at frequencies above about 13.5 MHz.

ANODE CHOKE

10. For the same reason, the anode r.f. choke L2 + L3 is made in two sections. L3 together with C8 provides the 'choke and bypass' action for the h.f. end of the operating range, C8 being switched into circuit by means of solenoid RLA. For the lower-frequency ranges, RLA is released; the choke is formed by L2 and L3 in series, with bypassing by C7.

ANODE AMPLITUDE DETECTOR

11. From a signal pick-up plate (which is located close to the valve anode), a signal proportional to that at the anode is developed across C1. After rectification, a negative-going d.c. level is developed at tag 8 of tagstrip TS6; this voltage provides the anode-derived input for the load discriminator circuit.

ANODE PHASE DISCRIMINATOR

12. The PA stage is tuned correctly when the r.f. signal at the valve anode is an amplified version of that at the control grid, with these signals mutually in anti-phase.

13. The function of the anode phase discriminator is to provide control signals for the servo system such that these conditions are obtained on completion of the fine-tuning sequence. The operation of the discriminator is described with the aid of a vector diagram.

Grid Sample

14. The current flowing in T4 primary is in-phase with the grid drive voltage. From this current, two equal but anti-phase signals are developed across R2 and R6 on the Discriminator Board. These signals are represented by vectors OA and OB in fig. 6.1.

Anode Sample

15. From a signal pick-up plate (which is located close to the valve anode), a signal proportional to that at the anode - but in quadrature with it - is developed across the 140 ohm load formed by R1, R5, R9 and R10 (Fig. 27). This signal is represented by vector OC.

16. Summing the grid-derived and anode-derived signals gives vectors AC and BC. The relative magnitude of these vectors is used to define the direction and degree of any mistuning.

17. The actual signals corresponding to vectors AC and BC appear at junctions D1, D2 and D3, D4 respectively. They are rectified individually, to produce d.c. outputs via tags 10 and 11 of TB6. These d.c. levels are passed to the Servo Preamp card (Chapter 4) where their algebraic sum provides the servo-control voltage.

18. On completion of the ramping procedure, the PA anode circuit will be set slightly on the low-frequency side of true resonance. At this stage, the relative phases of the grid and anode signals are (typically) as shown in fig. 6.1A. Vector BC predominates, and this produces a negative-going control voltage within the servo preamplifier.

19. During fine-tuning, the OC vector advances in phase to give the conditions shown in Fig. 6.1B. When the vector-sum signals AC and BC become equal, the servo-control voltage falls to zero and hence the servo motor is switched off.

20. Should the servo system overrun, the conditions of Fig. 6.1C will prevail. The resultant positive-going control voltage causes the motor to reverse direction and the circuit to be tuned 'downwards' towards resonance.

NEUTRALIZING

21. Feedback via the anode-to-grid capacitance of the valve can affect the intermodulation performance of the amplifier and, in extreme cases, cause instability. With switched input matching networks these effects are significant only in the frequency range above 20 MHz.

22. Via a pick-up plate adjacent to the valve anode a voltage of equal amplitude to that of the unwanted feedback is impressed on the primary of phase-inverting transformer T5. The resultant antiphase signal is fed to the valve grid where it cancels the unwanted feedback.

SERVO POWER AMPLIFIERS (Fig. 43)

23. The operation of the 'tuning' and 'loading' servo amplifiers is identical. The 'tuning' servo amplifier operation is described here.

24. The base-drive resistors for TR5 and TR6 are located on the Servo Preamp card in the Control Unit (see Fig. 6-2).

25. When the control voltage at junction D1, D2 rises above +2 V, D1 becomes reverse-biased. TR5 starts to conduct, drawing base current via R36. TR1 is switched 'on', to give a positive-going motor-drive signal.

26. When the control voltage reverts to 0 V, TR5 is switched off and in turn switches TR1 'off'. The motor-drive signal is cancelled.

27. When the control voltage goes more-negative than -2 V, TR6 is switched on and TR5 is reverse-biased. TR2 is switched on, to give a negative-going motor-drive signal.

CHAPTER 7

CIRCUIT DESCRIPTION - POWER SUPPLIES

CONTENTS

CHAPTER 7

CIRCUIT DESCRIPTION - POWER SUPPLIES

INTRODUCTION

1. The TA 1823 is powered from a 200 V to 250 V, single-phase a.c. supply. All the operating potentials required by the complete Linear Amplifier are derived from this supply via in-built power supply assemblies.

2. The main a.c. supply is applied via switching circuits to the primary windings of transformers T1, T2 and T3 (Fig.47). From the secondary windings of these transformers the following d.c. supply outputs are developed:

(1) +20 V (Unreg), rating 3 A max

(2) -20 V (Unreg), rating 3 A max

(3) +12 V, regulated, rating 1 A

(4) -12 V, regulated, rating 0.5 A

(5) +225 V, regulated, rating 50 mA

(6) -28 V to -45 V, regulated, rating 15 mA

(7) +2900 V (Unreg), rating 750 mA

(8) +28 V, regulated, rating 9 A

3. In addition, transformer T2 provides the 6 V a.c. supply for the PA valve heater and T3 provides the 115 V a.c. 800 mA supply for the solenoids .

20 V SERVO SUPPLIES

4. The two 14.5 V a.c. outputs from transformer T3 are rectified and smoothed to provide the +20 V and -20 V unstabilized supplies for the servo system. These outputs appear at tags 10 and 9 of tagboard TB3 and at pins 14 and 12 of the Auxiliary Power Supply Board.

+12 V AND -12 V REGULATED SUPPLIES

5. The +20 V and -20 V inputs to the Auxiliary Power Supply Board (Fig. 36) are passed to voltage regulator modules ML1 and ML2. The resultant +12 V and -12 V supply rails appear at pins 6, 7, 8 and 9, 10 respectively of tagboard TB4.

PA SCREEN-GRID SUPPLY

6. The 240 V a.c. output from T1 is rectified and smoothed and then applied to Zener diode chain D9 to D12, to produce the 225 V supply rail at tag 3 of TB4.

7. Current monitoring is effected by means of R5 and the front panel meter. The PA screen voltage monitor provides a +25 V (nominal) level across R7.

PA GRID BIAS SUPPLY

8. The 73 V a.c. output from T2 is rectified and smoothed to produce a -51 V rail across Zener diode D13. The precise PA grid bias voltage, in the range -28 V to -45 V is set by means of preset control R1.

EHT SUPPLY

9. The 3390 V a.c. output from T1 (Fig.47)is full-wave rectified and then smoothed by the choke-input filter L1, C2. (L1 is in the 0 V return path as this location minimises the insulation requirements for this item.)

10. A resistor chain on the EHT Monitor board (Fig.34) provides the +11 V EHT-Available signal for the Servo Control Card (Chapter 4) and the reference level for metering purposes. It also provides the discharge path for smoothing capacitor C2.

11. The EHT return line (board pin 1) provides the input for the PA cathode current monitoring facility. The network incorporates protection devices (SG1 and D1).

+28 V REGULATED SUPPLY

12. The +28 V regulated supply for the Drive Amplifier (Chapter 5) is derived from the 30 V a.c. output from T3. The supply is rectified and smoothed, on the Power Supply Tray (Fig.37) to provide a +40 V (nominal) rail across C3.

13. This +40 V rail provides the input for a switched-mode power supply unit (Fig.39) which provides the +28 V regulated output.

Switching Regulator

14. The basic switching regulator is formed by TR7 and TR8 (in parallel), D13, L1 and C16. The sequence of events is as follows.

15. When, the bases of the transistors are pulled 'down' towards 0 V by the action of TR6, supply current starts to flow via L1 to the external load (RL).

16. The magnitude of the current rises linearly at the rate determined by inductor L1 and the loop resistance. C16 starts to charge.

17. Before the current reaches its maximum permissible value (which is defined by the supply unit voltage and the loop resistance), the series transistors are switched-off.

18. The back-emf due to energy stored in L1 causes junction L1, D13 to go negative with respect to the 0 V rail; D13 starts to conduct. Current continues to flow into the load, circulating in the loop formed by L1, L2, RL and D13.

19. The energy stored in the inductor during the off-time of the transistors is sufficient to maintain the output power, but the magnetic field does not decay to zero. The series transistors are switched-on again, and the cycle of events is repeated.

20. The voltage developed across C16 is further smoothed by L2, C17 and hence a steady output voltage is developed at board pin 4.

Snubbing

21. The period between TR7 (and TR8) switch-off and D13 conduction is a potentially-hazardous one for the series transistors; this is avoided by the use of 'snubber' circuits.

22. The action of switching-on TR7 and TR8 initiates a current flow, which inductor L1 attempts to maintain after it is switched off.

23. When the transistors are switched-off, the potential at junction L1, D13 falls towards 0 V. The 'demand' for supply input current by L1 continues during this period and, if satisfied by TR7 and TR8, could result in an over-dissipation condition. Instead the current through L1 is provided by current pulses via paths D11, C13 and D12, C15. The capacitors become charged to the supply input voltage.

24. When junction L1, D13 goes negative with respect to the 0 V rail, D13 conducts to complete the current loop for the inductor.

25. When TR7 is switched-on again, C13 and C15 are discharged via R39 and R40 respectively.

Pulse-Width Control

26. The logic elements to effect pulse-width control of the switching regulator are contained in ML1. Circuit operation is described with the aid of the simplified diagram in Fig. 7.1

27. The control signals for the voltage-regulation loop are derived from a free-running bistable. C8 and R24 are the timing elements.

28. At the start of each cycle of events, there is zero voltage at pin 7 and a logic 0 level at pin 3. The ramp-comparator output is at logic 0.

29. The Q output of the bistable provides a logic 0 to NOR gate A. The $\overline{Q}$ output provides a logic 1 which forces gate B output to logic 0. Gate A output goes to logic 1; the associated output transistor is switched-on, giving a positive-going signal via pin 11 to TR6 base.

30. The timing capacitor (C8) starts to charge, causing a linearly-rising ramp voltage to be presented to the ramp-comparator. When the rising voltage reaches the +2.5 V reference level set by the error comparator, the ramp-comparator output goes to logic 1. Gate A output goes to logic 0; the output transistor is switched-off and hence the regulator-drive signal via pin 11 is cancelled.

31. When the ramp voltage reaches its maximum value, a logic 1 blanking pulse is generated at pin 3. This causes C8 to be discharged and the bistable to change state. Both output stages are switched-off, momentarily.

32. C8 again starts to charge and the sequence is repeated. Gate B is now active and hence a positive-going output is produced at pin 14.

33. When the ramp voltage again reaches its maximum value, the output via pin 14 is cancelled and the bistable reverts to its original state.

34. The entire cycle is repetitive at the rate determined by C8, R24. The positive-going outputs appear at pins 11 and 14 alternately, giving a push-push base drive signal for TR6; this causes TR7 and TR8 to be pulsed twice for each cycle of the bistable in ML1.

Voltage Regulation

35. A voltage proportional to that developed across C16 is presented, via potential-divider chain R20 to R22, to pin 1 of ML1. This voltage is compared with the +2.5 V reference level at pin 2; this is derived from an internal 5 V reference source (pin 16).

36. The resultant output from the error amplifier provides the reference potential for the ramp-comparator and hence constitutes the pulse-width control signal.

37. The potential at pin 1 of ML1 is +2.5 V under normal operating conditions. Adjustment of preset control R21 varies the output voltage from the error amplifier (i.e. the input to the ramp comparator); this produces a change in pulse width and hence a change in the output voltage across C16. This in turn produces a feed-back signal to ML1 which results in the maintenance of a +2.5 V level at pin 1.

38. Changes in the output current 'demand' result in only minor changes in the TR7, TR8 duty cycle; these are due to ohmic losses in L1 and L2. There is sufficient energy stored in L1 to supply the rated full-load current during the off-periods of the transistors.

39. Changes in the supply input voltage (i.e. mains supply variation) produce only minor changes in the +28 V output level. The error amplifier in ML1 has a high stage-gain; thus a small change in output voltage will be sufficient to effect a change in TR7, TR8 duty cycle and hence maintain the desired output voltage.

Overvoltage Protection

40. Under normal conditions, a +27.5 V (nominal) level is developed across C5. Zener diode D7 is conducting, via R14, to provide a reference voltage for TR4.

41. A voltage proportional to that across C16 appears at TR4 base. This level is adjusted, by means of R11, such that TR4 is non-conducting.

42. Should a fault occur such that the output voltage at C16 rises above +32 V (e.g. there is a short-circuit within TR7), the voltage at TR4 base will exceed the threshold set by R11.

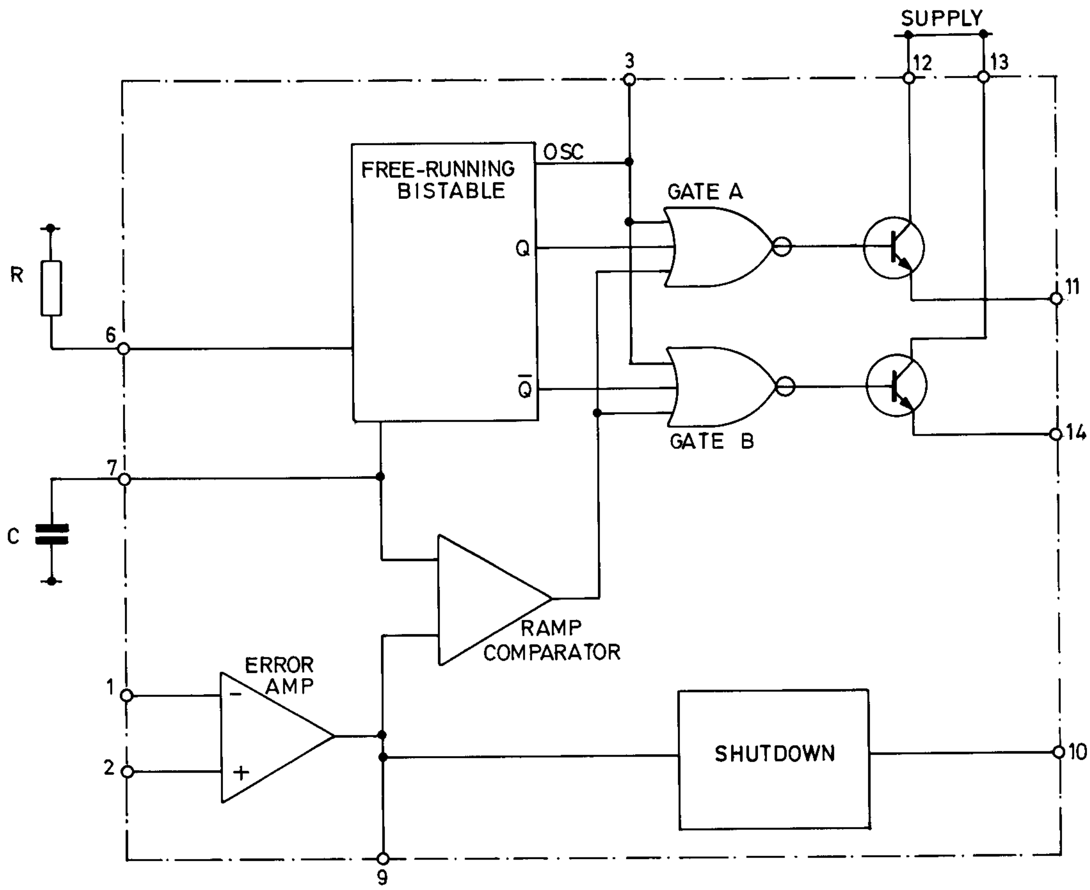
43. TR4 starts to conduct, causing TR5 to conduct; the junction R17, R18 rises towards +27 V. The positive-going signal developed across R19 triggers SCR1, resulting in a short-circuit across the 28 V output rail - and the rupture of fuse FS1.

44. The voltage at D8 anode collapses immediately but that at D8 cathode is maintained by C5 for a short period.

45. The positive-going signal via R17, D6 locks TR4 and TR5 'on'. The positive-going signal via R13, D5 switches TR2 'on' and in turn causes TR3 to conduct. The junction R8, D3 rises towards +40 V and gives via R7 a Shutdown instruction for ML1. The current through R8 causes TR4 and TR3 to be latched 'on'.

FILTER UNIT (Fig.41)

46. By its nature, the switched-mode power supply can produce interference signals on its input and output lines. Suppression of these unwanted signals is effected in the Filter Unit, a self-contained item. The circuit operation is self-explanatory.



RACAL
TH2354

Simplified Block Diagram:
Pulse-Width Control

Fig.7.1

CHAPTER 8

VSWR UNIT

CONTENTS

CHAPTER 8

VSWR UNIT

INTRODUCTION

1. The VSWR Unit monitors the forward and reflected power levels on the r.f. output feeder, and produces d.c. voltages corresponding to these levels.

2. The ideal operating condition for the Linear Amplifier is when the external load impedance, presented by the antenna system, is non-reactive and precisely 50 ohm in value. Under practical conditions, the load impedance may depart from the nominal value and may be partially reactive.

3. The d.c. outputs representing the particular operating conditions are used for metering purposes. They are also used as warning signals should the VSWR coefficient exceed a predetermined level.

CIRCUIT DESCRIPTION

4. The VSWR Unit uses reflectometer techniques and these are described with the aid of a vector diagram.

5. From the capacitive divider former by C1 and C3, C4 (Fig.46), a signal proportional to - and in-phase with - the output voltage is developed across C4. This signal is represented by vector OC in Fig. 8-1A.

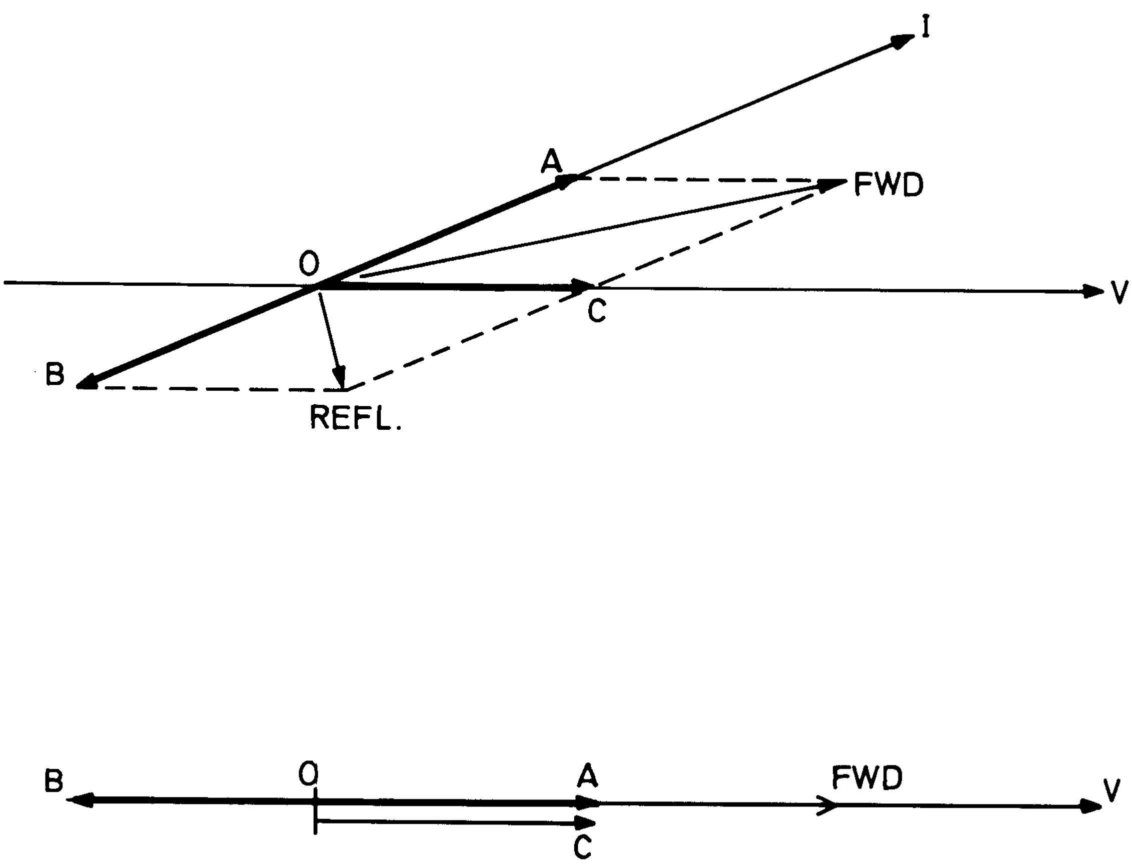
6. From the load current flowing in the primary of the toroidal transformer, two equal but anti-phase signals are developed across R1 and R2. These signals are represented by vectors OA and OB respectively.

7. The phase angle between the load current and the output voltage is directly related to the reactive component (if any) of the external load impedance. When the load is non-reactive, the current will be in-phase with the output voltage (para 10).

8. Summing the voltage-derived and current-derived signals gives two vectors which define the relationship between the forward and reflected power levels.

9. The signals corresponding to these vectors appear between board pin 1 and OV and pin 2 and OV respectively. The signals are rectified individually, and the resultant d.c. levels are fed via board pins 5 and 4 to the ALC card (Chapter 4).

10. Preset control C3 is adjusted during manufacture such that, with a 50 ohm non-reactive load, the signals represented by vectors OA, OB and OC are of equal magnitude. For this condition, the algebraic sum of OA and OC is twice OA and that of OB and OC is zero - as shown in Fig. 8-1B.



Vector Diagram: VSWR Unit

Fig.8.1

CHAPTER 9

MANUAL RANGE SELECTION

CONTENTS

CHAPTER 9

MANUAL RANGE SELECTION

INTRODUCTION

1. Under normal operating conditions, the fixed-value capacitors for the PI-L output network are selected automatically in the manner described in Chapter 4.

2. When the manual tuning mode is selected, these capacitors are selected by means of the MANUAL RANGE SELECTION switch (S2 in Fig 47).

MANUAL TUNING SELECTED

3. Whilst the range-selection switch is set to AUTO, a 0 V Auto-Tuning-Selected signal is presented to the Servo Preamp, Servo Control and Switch-on Sequence Cards in the Control Unit; when the switch is moved from the AUTO position, the 0 V signal is cancelled.

4. On the Servo Preamp Card, relays RLA and RLB are released and hence the control signals for the Servo Power Amplifier stages are disconnected; the servo system is disabled, with the motors 'at rest'.

5. A Reset signal, from the Switch-on Sequence Card, disables the SCR-control circuits on the Thyristor Decoder Card.

6. From the MANUAL RANGE SELECTION switch, a 0 V input corresponding to the desired frequency range is applied to the Manual Override Board (Fig. 32).

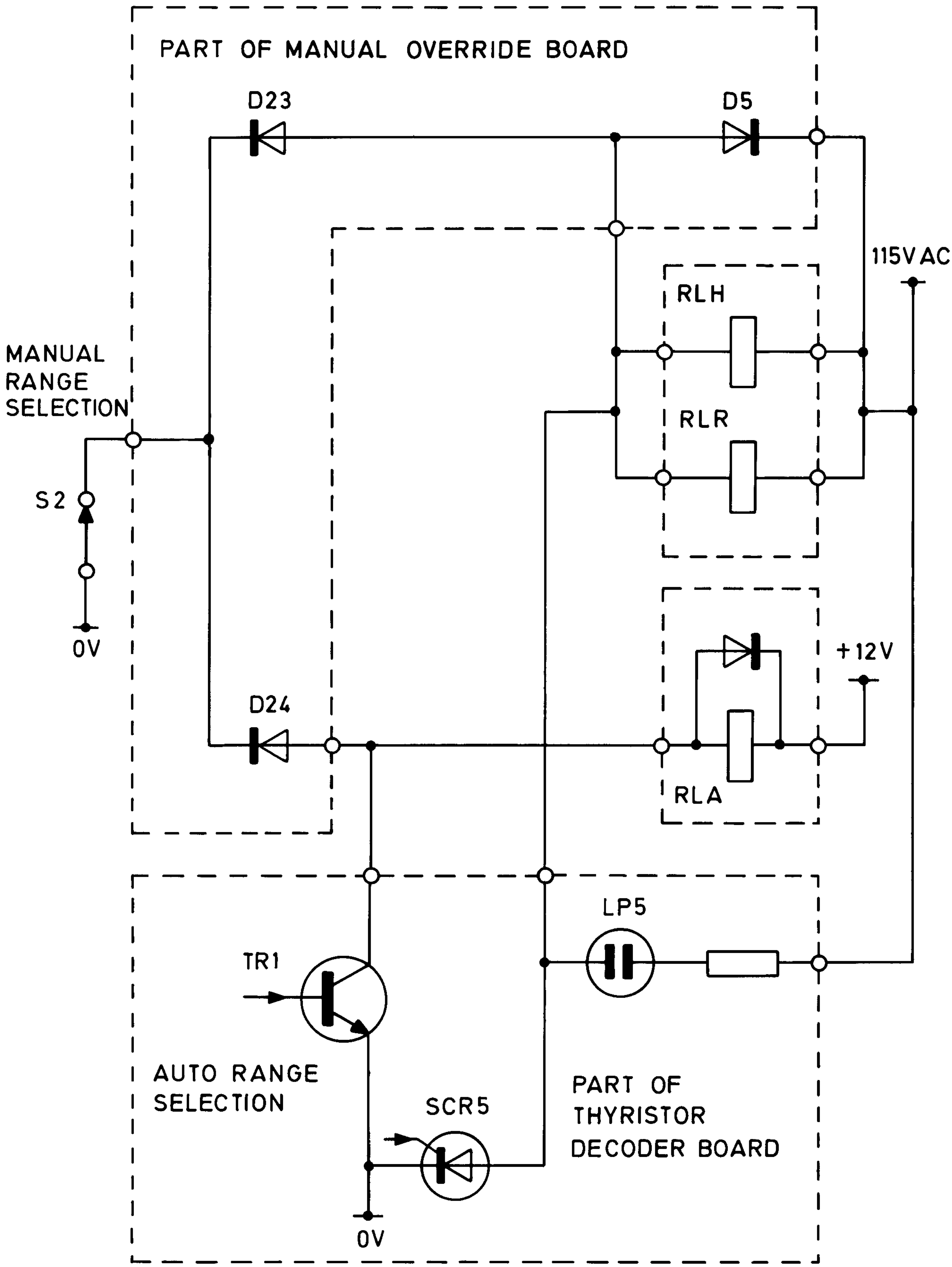
DIODE MATRIX

7. The Manual Override Board carries a diode matrix, the outputs from which provide 0 V control signals for the capacitor - selection solenoids and for filter-network selection on the Input Matching board (Fig 47). These 0 V levels take the place of those normally obtained from the Thyristor Decoder card.

8. A simplified circuit for the 2.71 MHz to 4.05 MHz frequency range is given in Fig 9.1. The requirements for manual selection of each of the eight ranges are found by inspection of Fig 32.

SURGE PROTECTION

9. In addition to the matrix, the Manual Override Board carried surge - protection diodes for the solenoids. When a solenoid is operated, either via the diode matrix or via an SCR on the Thyristor Decoder Card, current is drawn during the positive half-cycle of the 115 V a.c. supply. When this supply voltage falls to zero and then goes negative, the relevant protection diode conducts to suppress any inductive surge from the solenoid.



Simplified Circuit: Range Selection Fig. 9.1

CHAPTER 10

ROUTINE MAINTENANCE

CONTENTS

CHAPTER 10

ROUTINE MAINTENANCE

GENERAL

1. Routine maintenance consists of a periodic examination of electrical contacts, cleaning of equipment and a check of all mechanical fixings.

WARNING ACCESS FOR MAINTENANCE PURPOSES REQUIRES THE REMOVAL OF PROTECTIVE COVERS.
NO INTERNAL EXAMINATION OR ADJUSTMENT MAY BE ATTEMPTED UNTIL THE CABINET HAS BEEN ISOLATED FROM THE MAIN SUPPLY AND UNTIL ALL HIGH-VOLTAGE POINTS HAVE BEEN EARTHED (THE EARTHING STICK IS LOCATED ON THE BASEPLATE OF THE CABINET).

AIR BLOWER

2. The bearings of the air blower unit are 'sealed for life' and hence require no lubrication.

3. Dust in the vanes of the airblower may be cleared with the aid of a low-pressure airline.

AIR FILTER

4. The air filter should be removed at three monthly intervals - or more frequently according to local conditions - and washed in warm soapy water.

5. Make sure that the filter element is completely dry before refitting it to the cabinet.

6. The filter, which is secured by four captive screws, should lie flat against the rear of the cabinet and leave no air-gap.

AIR DUCTS

7. Cleaning of the PA grid compartment is carried out with the aid of a vacuum cleaner and a soft brush. A 'gentle touch' is required to ensure that the grid-circuit components are not disturbed.

8. Cleaning of the PA anode compartment is carried out in a similar manner, after the removal of the coverplate (eight screws).

9. Dust in the vanes of the PA valve can be cleared with the air of a low-pressure airline.

DRIVE AMPLIFIER

10. Cleaning of the drive amplifier heat sink assembly is effected by vacuum cleaner-and-soft brush action.

SUPPLY RELAYS

11. The contacts of the supply relays RLA and RLB should be examined for signs of pitting or burning. Any faulty items should be replaced.

CAPACITOR-SELECTION SOLENOIDS

12. The contacts of the ac-operated solenoids should be examined for signs of pitting or burning, and the push-rods should be checked for free movement. Any faulty items should be replaced.

TUNE COIL ASSEMBLY

13. The insulators of the tune coil should be wiped clean.

14. The sliding contacts should be examined for signs of wear or burning, and replaced or adjusted as appropriate.

15. Do not remove the black (graphite) coating on the coil.

16. The coupling between the servo motor and the coil should be checked for 'tightness'; a small amount of free movement should be allowed. The fixing screws for the coupling should be checked for tightness.

17. Note that lubrication is not required on the coil-drive gears.

LOAD COIL ASSEMBLY

18. As for the tune coil assembly.

'POZIDRIV' SCREWDRIVERS

Metric thread cross-head screws fitted to Racal equipment are of the 'Pozidriv' type. Phillips type and 'Pozidriv' type screwdrivers are not interchangeable, and the use of the wrong screwdriver will cause damage. POZIDRIV is a registered trade mark of G.K.N. Screws and Fasteners Limited. The 'Pozidriv' screwdrivers are manufactured by Stanley Tools Limited.

CHAPTER 11

DISMANTLING AND REASSEMBLY

CONTENTS

CHAPTER 11

DISMANTLING AND REASSEMBLY

INTRODUCTION

1. This Chapter gives the dismantling and reassembly procedures for the TA 1823.

WARNING: BEFORE ANY DISMANTLING IS ATTEMPTED, THE EQUIPMENT MUST BE DISCONNECTED FROM THE AC SUPPLY AND ALL HIGH-VOLTAGE POINTS MUST BE EARTHED (USING THE EARTHING STICK PROVIDED).

2. (1) Check that the RF Compartment door is closed and secure.

(2) Set the Cabinet Master switch to EHT SHORTED.

(3) Remove the eighteen screws securing the front panel. Leave the cover for the manual tuning controls in place.

(4) Ease the front panel assembly outwards at the top until clear of the interlock mechanism, and then lift upwards until the lugs are disengaged from the slots at the bottom.

REMOVAL OF THE PA VALVE

3. (1) Remove the front panel.

(2) Remove the eight screws securing the cover plate for the PA anode compartment and lift the cover plate clear.

(3) Unclip the earthing stick from the bottom plate of the cabinet, and apply to the valve anode and to the other high-voltage points in the vicinity.

(4) Loosen the screws securing the anode connector and disengage the connector.

(5) Rotate the valve 60 degrees in an anticlockwise direction and then withdraw via the front of the RF Compartment.

REMOVAL OF LOAD COIL ASSEMBLY

4. (1) Remove the front panel (para 2).

(2) Disengage the connections from tagstrip 5TS1 and lift the fanning strip clear.

(3) Remove the connection between the top of the coil and the inner conductor of the coaxial cable. Dress the cable close to the compartment wall.

(4) Remove the strap connection between the bottom of the coil and the contact bar for the capacitors; hold the junction steady whilst removing the nut and bolt. When separating the strap connection, take care not to bend the contact bar; disturbance of the bar can affect the alignment of the solenoid assembly.

(5) Loosen the two captive screws securing the RF Compartment door. Hinge the door fully open, and hold it steady.

(6) Remove the six screws, at the rear of the RF Compartment, securing the load coil assembly.

(7) At the front of the Compartment, provide a temporary support for the coil assembly. Then remove the remaining fixings (one screw each side of the mechanical coupling).

(8) Lift the complete coil assembly forward until clear.

REMOVAL OF PHASE DISCRIMINATOR BOARD

5. (1) Carry out operations 4(1) to 4(8) inclusive.

(2) Remove the four screws securing the cover for the discriminator assembly. Lift the cover clear.

(3) Remove the four screws securing the board to the wall of the PA anode compartment.

(4) Note the colour-code and position of the connecting leads, and then unsolder as appropriate.

REMOVAL OF TUNE COIL ASSEMBLY

6. (1) Remove the front panel (para 2)

(2) Disengage the connections from tag strip 4TS1 and lift the fanning strip clear.

(3) Remove the strap connections between the top of the coil and the anode 'feed' components, and between the bottom of the coil and the contact bar for the capacitors.

(4) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(5) Remove the four screws securing the Servo Power Amplifier assembly. Lift the assembly clear to the extent of the cableform, and provide a temporary support for it.

(6) Remove the six screws, at the rear of the Compartment, securing the tune coil assembly.

(7) At the front of the Compartment, provide a temporary support for the coil assembly. Then remove the remaining fixings (one screw each side of the mechanical coupling).

(8) Lift the complete coil assembly forward until clear.

(9) As a precaution, refit the Servo Power Amplifier assembly to the rear of the door.

REMOVAL OF AMPLITUDE DISCRIMINATOR BOARD

7. (1) Carry out operations 6(1) to 6(9) inclusive.

(2) Remove the four screws securing the cover for the discriminator assembly. Lift the cover clear.

(3) Remove the four screws securing the board to the wall of the PA anode compartment.

(4) Note the colour-code and positions of the connecting leads, and then unsolder as appropriate.

REMOVAL OF ANODE-DECOUPLING COMPONENTS

8. Remove the LOAD coil assembly (para 4) and the TUNE coil assembly (para 6). The method of removal of individual decoupling components is then self-explanatory. Note the colour code and position of any wires to be unsoldered.

REMOVAL OF THE PA CAPACITOR ASSEMBLY

9. Access to individual anode-tuning capacitors is possible after the removal of the TUNE coil assembly, and access to loading capacitors is possible after the removal of the LOAD coil assembly. The complete removal of one or more capacitors is best accomplished by removing the capacitor assembly as an entity.

10. (1) Remove the PA Valve (para 3).

(2) Mark the position of the Neutralizing plate. Remove the two screws securing the plate and lift aside.

(3) Remove the three stainless steel screws securing the vertical plate of the capacitor assembly to the PA anode compartment.

(4) Disconnect and remove the strap connection between C24 and the contact bar for the TUNE capacitor assembly.

(5) Disconnect the lower strap connection from the TUNE coil.

(6) Disconnect the lower strap connection from the LOAD Coil.

(7) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(8) From the underside of the door, remove the five stainless steel screws securing the capacitor assembly.

(9) At the rear of the door, disengage the 'solenoid' fanning strips from tagblocks TB7 and TB8.

(10) Provide a temporary support for the capacitor assembly.

(11) At the rear, remove the eight stainless steel screws securing the capacitor assembly to the door.

(12) Ease the complete assembly forward whilst passing the fanning strips through their respective slots. Lift the assembly clear and place on a suitable protective pad.

(13) The method of removal of individual items is self-explanatory. Note the positions of the strap connections, and the colour code of any wires to be unsoldered.

REMOVAL OF INPUT MATCHING BOARD

11. (1) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(2) Unsolder the PA valve heater lead.

(3) Noting their colour codes and positions, unsolder the leads from pins 1, 4 to 19 and 22 to 27 on the Input Matching board.

(4) Remove the four screws securing the board. Ease the board rearwards until clear.

REMOVAL OF SERVO POWER AMPLIFIER

12. (1) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(2) Disengage the fanning strip from tagblock TB9.

(3) Remove the four screws securing the amplifier assembly to the pillars and lift the assembly clear.

REMOVAL OF DRIVE AMPLIFIER

13 (1) Open the RF Compartment door.

(2) Noting their respective positions, disconnect the coaxial cables from SK1 and SK2.

(3) Disengage the multiway connector from PL1.

(4) Remove the four screws (two each top and bottom) securing the assembly and lift clear.

REMOVAL OF THE AIR BLOWER

14. (1) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(2) Disengage the two push-fit connectors from the Fan-Fail microswitch (S4).

(3) Disengage the four 'blower' connections on terminal block 4TB5.

(4) Remove the Air Filter (rear of cabinet).

(5) Remove the Motor-Run capacitor (C40), which is located at the rear of the blower assembly.

(6) From the rear, remove the four screws (two each side) securing the output duct of the blower to the front panel of the air box.

(7) From the front, remove the four screws securing the upper bracket for the fan mounting to the front panel of the air box.

(8) Gently withdraw the blower assembly via the rear of the cabinet.

REMOVAL OF SWITCHED-MODE POWER SUPPLY AND FILTER BOX

15. (1) Open the RF Comparment door, hinge it back and hold it steady in the fully-open position.

(2) Disengage the three connectors (two coaxial and one multiway) from the Drive Amplfier.

(3) Noting its orientation, disengage the fanning strip from tagblock 6TB1 on the Filter Box.

(4) Remove the four screws securing the Filter Box.

(5) Rotate the Filter Box 90 degrees clockwise, in order to gain access to the fanning strip on the Power Supply (referenced TB1).

(6) Noting its orientation, disengage the fanning strip from the Switched-Mode Power Supply.

(7) Lift the Filter Box clear.

(8) Remove the six screws securing the Power Supply Assembly to its box.

(9) Carefully lift the Power Supply Assembly clear.

REMOVAL OF THE VSWR UNIT

16. (1) Remove the blanking plate or RF Drive Unit (if fitted).

(2) Remove the four screws securing the Control Unit.

(3) Ease the Control Unit forward and provide temporary support. Disengage the two multiway and the two coaxial connectors from the rear of the unit. Lift the Control Unit clear.

(4) Remove the four screws securing the top cover of the VSWR Unit and lift clear.

(5) Disengage the coaxial connector. Noting their colour code, unsolder the d.c. output leads.

(6) Remove the four nuts securing the VSWR Unit to the rear panel of the cabinet, and lift the unit clear.

REMOVAL OF FUSE-PANEL-MOUNTED ITEMS

Note: If the Master Switch and Fuse Panel is disturbed, this will entail realignment between the switch and the interlock mechanism on the front panel of the equipment (see para 31).

17. (1) Open the RF Compartment door, hinge it back and hold it steady in the fully-open position.

(2) Remove the four screws (two at each end) securing the Master Switch and Fuse Panel Assembly. Ease the assembly forward to the extent of the cableforms.

18. To remove the Cabinet Master Switch:

(1) Carry out operations 17 (1) and 17 (2).

(2) Remove the four screws securing the safety cover. Lift the cover clear.

(3) Remove the two screws securing the EHT Shorting Bar to the switch spindle.

(4) Noting the colour code and orientation of each lead, remove the connections from the switch.

(5) Remove the two screws securing the switch to the panel, and withdraw from the rear.

19. To remove the Manual Override Board,

(1) Carry out operations 17 (1) and 17 (2).

(2) Noting their colour code and positions, unsolder the connections from the board.

(3) Remove the four screws securing the board to the pillars, and lift the board clear.

20. To remove the Manual Range Selection switch,

(1) Carry out operations 17 (1) and 17 (2).

(2) Remove the cover from the control knob and then release the collet nut. Withdraw the knob.

(3) Noting their colour code and positions, unsolder the connections from the switch.

(4) Remove the nut securing the switch to the panel, and withdraw from the rear.

21. The procedure for the removal of the fuse holders and other small items are self-explanatory, after carrying out operations 17 (1) and 17 (2).)

DISMANTLING THE CONTROL UNIT

22. (1) Remove the blanking plate or RF Drive Unit (if fitted)

(2) Remove the four screws securing the Control Unit.

(3) Ease the Control Unit forward and provide temporary support. Disengage the two multiway connectors and the two coaxial connectors from the rear of the unit.

(4) Lift the Control Unit clear and place it on a suitable protective pad.

(5) Remove the front cover plate (two Dzus fasteners).

(6) Noting their original positions, gently withdraw the six plug-in printed-circuit boards.

Removal of Front-Panel-Mounted Items

23. (1) Carry out operations 22 (1) to 22 (6).

(2) Remove the four cross-headed screws (two each end) securing the front panel to the side members and the countersunk screw at bottom centre of the panel.

(3) Hinge the panel downwards to the extent of the cableforms.

24 To remove the meter:

(1) Carry out operations 23 (1) to 23 (3).

(2) Disengage the two meter connections.

(3) Release the two spring clips.

(4) Withdraw the meter unit from the rear of the panel. and the meter bezel from the front.

25. To remove a pushbutton switch:

(1) Carry out operations 23 (1) to 23 (3).

(2) Remove the two screws securing the pushbutton assembly to the front panel. Withdraw the assembly from the rear.

(3) Remove the two screws securing the assembly to the bracket.

(4) Noting their colour code and positions, unsolder the connections as appropriate.

(5) Unclip the faulty item from the bearer bar.

26. To remove an LED indicator:

(1) Carry out operations 23 (1) to 23 (3).

(2) Noting their colour code and position, unsolder the connections.

(3) Withdraw the retaining ring and the LED element from the rear of the panel, and the bezel from the front.

27. To remove the meter switch:

(1) Carry out operations 23 (1) to 23 (3).

(2) Set the meter switch to OFF.

(3) Remove the cover from the control knob and then release the collet nut. Withdraw the knob.

(4) Noting their colour code and positions, unsolder the connections from the switch.

(5) Remove the nut securing the switch to the front panel, and withdraw from the rear.

Access to Rear of the Motherboard Assembly

28. (1) Carry out operations 22 (1) to 22 (6).

(2) Remove the four screws (two at each end) securing the rear panel to the side members, and four countersunk screws on the rear underside of the unit.

(3) Hinge the rear panel assembly downwards to the extent of the cableforms.

(4) Remove the slide-lock posts from connectors PL1 and SK1 (two nuts for each connector). Note the number and position of any spacer-washers.

(5) Remove the six screws securing the Motherboard Assembly to the rear panel.

(6) Gently hinge the Motherboard and the rear panel apart, to the extent of the wiring to sockets SK2 and SK3.

(7) Removal of individual items may now be effected using established techniques. Note that the printed circuit board has plated-through holes.

Note: Do not attempt to remove the screws securing the Motherboard to the carrier bars (at top and bottom), because this could result in misalignment between the edge connectors and the guides for the six plug-in printed- circuit boards.

REASSEMBLY

29. The reassembly procedures are, in general, the reverse of those given for dismantling.

30. Five of the eighteen screws which secure the front panel to the cabinet are shorter than the remainder. These five screws must be inserted adjacent to the door hinge.

31. If the Master Switch and Fuse Panel Assembly has been disturbed (para 17), the Cabinet Master Switch must be re-aligned with the mechanical interlock:-

(1) Fit the assembly to the cabinet and insert the four fixing screws. Leave the screws finger-tight so that the assembly is free to move.

(2) Set the Cabinet Master switch to the EHT-SHORTED position (fully anticlockwise).

(3) Set the control lever for the Cabinet Master switch to this position and then close the RF Compartment door.

(4) Make slight adjustments such as to align the Master Switch with the mechanical interlock, and then secure the Fuse Panel Assembly using the four screws.

DANGER

LETHAL VOLTAGES
EXIST IN THIS
EQUIPMENT

GREAT CARE MUST BE TAKEN WHEN CARRYING OUT TESTS DETAILED IN THIS HANDBOOK. STAND ON A RUBBER MAT AND DO NOT TOUCH ANY EXPOSED PART OF THE EQUIPMENT WHEN THE POWER IS ON.

BERYLLIUM OXIDE - SAFETY PRECAUTIONS

INTRODUCTION

The following safety precautions are necessary when handling components which contain Beryllium Oxide. Most RF transistors contain this material although Beryllium Oxide is not visible externally. Certain heatsink washers are also manufactured from this material.

PRACTICAL PRECAUTIONS

Beryllium Oxide is dangerous only in dust form when it might be inhaled or enter a cut or irritation area. Reasonable care should be taken not to generate dust by abrasion of the bare material.

Power Transistors

There is normally no hazard with power transistors as the Beryllium Oxide is encapsulated within the devices. They are safe to handle for replacement purposes but care should be exercised in removing defective items to ensure that they do not become physically damaged.

They MUST NOT:

(a) be carried loosely in a pocket, bag or container with other components where they may rub together or break and disintegrate into dust,

(b) be heated excessively (normal soldering is quite safe),

(c) be broken open for inspection or in any way abraded by tools.

Heatsink Washers

Heatsink washers manufactured from Beryllium Oxide should be handled with gloves, cloth or tweezers when being removed from equipment. They are usually white or blue in colour although sometimes difficult to distinguish from other types. Examples of washers used are 917796, 917216 and 700716.

They MUST NOT:

(a) be stored loosely,

(b) be filed, drilled or in any way tooled,

(c) be heated other than when clamped in heatsink application.

DISPOSAL

Defective and broken components must not be disposed of in containers used for general refuse. Defective components should be individually wrapped, clearly identified as "DEFECTIVE BERYLLIA COMPONENTS" and returned to the Equipment Manufacturer for subsequent disposal.

Broken components should be individually wrapped and identified as "BROKEN BERYLLIA COMPONENTS". They must not be sent through the post and should be returned by hand.

MEDICAL PRECAUTIONS

If Beryllia is believed to be on, or to have entered the skin through cuts or abrasions, the area should be thoroughly washed and treated by normal first-aid methods followed by subsequent medical inspection.

Suspected inhalation should be treated as soon as possible by a Doctor - preferably at a hospital.

Servo Pre Amp.

R 30 (220k) shunt with 15k in series with 0·47μ

R 44 (270k) shunt with 33k in series with 0·47μ

R 27 10Ω replace with 33k.

R 31 10Ω replace with 33k.

R 47 6k8 change to 27k

Counter card.

R 7	22k
R 8	56k
R 9	10k
R 11	6k2
R 12	5k6
R 15	4k7
R 16	3k3
R 17	2k7

R 23	22k
R 24	15k
R 25	6k8
R 26	5k6
R 27	4k7
R 28	3k3
R 29	~~3k3~~ 3k3
R 30	~~2k7~~ 3k3

DONE TO HERE

CHAPTER 12

TEST AND ALIGNMENT

CONTENTS

CHAPTER 12

TEST AND ALIGNMENT

INTRODUCTION

1. Test and Alignment procedures are given for the Drive Amplifier and for the overall TA 1823 Linear Amplifier.

WARNING: HIGH VOLTAGES EXIST WITHIN THE LINEAR AMPLIFIER. ENSURE POWER IS REMOVED AND CAPACITORS ARE DISCHARGED BEFORE CARRYING OUT ANY WORK ON THE UNIT

2. The procedures given should be used after repair of the unit or if components have been replaced. It is not necessary to carry out the procedures as part of a periodic maintenance scheme. Except where stated otherwise, a programme of tests is carried out as a continuous sequence.

DRIVE AMPLIFIER TEST AND ALIGNMENT

3. The procedures given in the following paragraphs can be carried out only when the drive amplifier has been removed from the cabinet and placed on a bench. It is necessary to provide power supplies and RF input and output connections.

CAUTION: It is necessary to provide a cooling air flow over the drive amplifier when it is on the bench, to simulate the normal cabinet cooling air system. The heatsink temperature must be continually monitored, and not allowed to exceed 85°C.

Test Equipment Required For Drive Amplifier

4. The following test equipment is required to carry out the Drive Amplifier test and alignment procedures given in this chapter (see para 11 for overall test equipment required).

(1) Reflection Coefficient Bridge with 50 ohms Termination
(Example: Texscan RCB-3)

(2) Mismatch Load 1.5:1 into 50 ohms
Suitable for use with Item (1) above.

(3) Swept Frequency Display Unit
(Example: Rohde and Schwarz Polyskop SWOB).

(4) Two Tone RF Generator
(Racal TG. 3605)

(5) Stepped Attenuator
Impedance: 50 ohms
(Example: Samwell and Hutton Type 129)

(6) R.F. Electronic Voltmeter, with 50 ohms In Line Probe Head
(Example: Marconi Type TF. 1041 C and TM. 5031 B)

(7) 50 ohms RF Load
Capable of handling 25 Watts C.W.
V.S.W.R. better than 1.2:1 over the range 1.6 to 30 MHz.
(Example: Bird Model 8135)

(8) RF Monitor Box (30 dB coupler): this is a simple unit, which can be locally manufactured. The box allows an electronic voltmeter to be connected to the load (see figs 12.1 and 12.4)

(9) Spectrum Analyser
Range:- 0 to 110 MHz
(Example:- Hewlett Packard HP.141T, 8552B, 8553B)

(10) Power Supply Unit (2 off in parallel)
Voltage: +28 volts d.c.
Current: at 9 Amps
(Example: Coutant LB 500.2)

Preliminary Procedure

5. (1) On the Power Supply Unit, set the output voltage to 28 volts and set the current-output limiter to 9 amps. Set the Power Supply switch to OFF.

(2) Mount the Amplifier to be tested on the bench, and provide a cooling air flow (see para 3).

Quiescent Current Setting

6. (1) Refer to Fig. 12.1 and interconnect the Drive Amplifier and the test equipment.

(2) Set the range of the electronic voltmeter to 100 volts FSD.

(3) Rotate R 34 and R 36 both fully clockwise.
Remove link LK.1 if fitted.

(4) On the d.c. Power Supply Unit, set the switch to ON. Ensure that, following any switch-on surge, the electronic voltmeter indicates zero.

(5) On the Drive Amplifier, adjust R 36 for a standing current of 1.8 amps. On the d.c. Power Supply Unit, set the switch to OFF.

(6) Make link LK 1. Set the switch on the Power Supply Unit to ON. Adjust R 34 until the total current drawn reaches 8.5 amps. Set the d.c. supply switch to OFF.

7. RF Gain and Frequency Response Test

(1) Set the controls of the Polyskop to display a frequency range of 1.5 to 31 MHz by adjusting the FREQUENCY, SWEEP WIDTH and CENTRE FREQUENCY controls. On the Polyskop connect its output directly to its input.

(2) On the Polyskop set the controls as follows:-

Output Attenuator	to minus 10 dB
Y1 MODE Control	to HF B
Y2 MODE Control	to EMF

(3) Adjust the Y1 GAIN control for a trace at approximately mid-screen. Overlay this with the Y2 trace as a reference. Increase the output attenuator setting for a further 40 dB of attenuation.

(4) Connect the Polyskop to the Drive Amplifier as shown in Fig 12.1. On the d.c. Power Supply Unit, set the switch to ON. Ensure that the current drawn is within the limits of 8 to 9 amps.

(5) Using the Polyskop output attenuator and taking into account the initial 10 dB setting, measure the minimum gain of the Drive Amplifier in the 1.6 MHz to 30 MHz range. Ensure that the minimum gain exceeds 30 dB.

(6) Measure the maximum gain in the range 1.6 to 30 MHz. Ensure that the gain does not exceed 42 dB.

(7) On the d.c. Power Supply Unit, set the switch to OFF. Disconnect the Polyskop from the Drive Amplifier.

Input VSWR

8. (1) Set the reflection coefficient bridge as shown in Fig 12.3, with a 1.5:1 load connected to 'Z1'.

(2) Adjust the EMF line for mid-screen.

(3) Adjust the Y1 gain until the traces are co-incident.

(4) Remove the 1.5:1 load and connect 'Z1' to the Drive Amplifier

(5) On the d.c. Power Supply, set the switch to ON. Ensure that the trace displayed is below the reference line i.e. a VSWR of better than 1.5:1.

Muting

9. (1) Connect the Drive Amplifier to the test equiment as shown in Fig. 12.4. On the d.c. Power Supply unit, set the switch to ON.

(2) Set the two tone signal generator frequency to 30 MHz. Set the mode to CW and adjust the output level until the RF Voltmeter indicates 35.4 volts (25W in 50 ohms).

(3) Adjust the spectrum analyser to display the 30 MHz signal.

(4) Adjust the display to the reference level at the top of the screen.

(5) Mute the amplifier, by earthing pin 4 on the printed-circuit board. Ensure that the signal decreases by not less than 50 dB.

(6) Demute the amplifier (remove the 'earth' from pin 4). On the d.c. Power Supply Unit set the switch to OFF. Disconnect the test equipment.

OVERALL LINEAR AMPLIFIER TEST AND ALIGNMENT

10. The procedures given in the following paragraph apply to the complete unit, and assume that the Drive Amplifier has been adjusted as given in paras 5 to 9.

WARNING: OBSERVE ALL SAFETY PRECAUTIONS. THE USE OF A SEPARATE 'KEY' OVERRIDES THE SAFETY INTERLOCKS OF THE CABINET. EXTREME CARE MUST BE EXERCISED WHILST AC POWER IS PRESENT WITHIN THE TA 1823.

Test Equipment Required for Overall Test and Alignment

11. The following test equipment is required for overall test and alignment.

(1) Drive Unit
(Example: Racal MA 1720)

(2) Control Unit Extender Card
(An extender card CA 82075 is supplied with the equipment)

(3) RF Attenuator Switched 50 Ω
(Example : Sanwell and Hutton Type 129)

(4) 1 kW RF 50 Ω Load complete with meter.
(Example : Bird 694)

(5) Digital Multimeter
(Example : Racal 9970)

Note: The test Leads for this meter should be as short as reasonably practicable, and passed round a ferrite ring several times to reduce RF susceptibility.

(6) Reflection Coefficient Bridge with 50 Ω and standard mismatches
(Example : Texscan RCB-3)

(7) Swept Frequency Display Unit
(Example : Rolide & Schwarz Polyskip)

(8) Oscilloscope min 30 MHz B/W 5 mV sensitivity
(Example : Tektronix 454)

(9) RF Electronic Voltmeter, with 50 ohms In-Line Probe Head
(Example : Marconi Type TF. 1041 C and TM. 5031 B).

12. Preliminary Procedure

(1) Ensure that the mains supply is switched off, and that capacitors have been discharged via earthing spike.

(2) Connect the TA 1823 and associated test equipment as in Fig. 12.5.

(3) Remove the EHT Fuse from its holder on the switch panel.

(4) Remove the board frame cover from the front panel of the Control Unit.

(5) Remove the ALC Card and set the preset controls as follows:-

R6, fully clockwise
R7, fully clockwise
R15, fully clockwise
R31, fully anticlockwise
R32, fully anticlockwise

(6) Reconnect the ALCCard using the extender card.

(7) Withdraw the Servo Preamp Card from the Control Unit and set all preset controls to mid-travel. Replace the Card.

(8) Set the controls and switches of the TA 1823 as follows:

Main Supply Switch	: EHT SHORTED
Manual Tune/Operate Switch	: TUNE
Manual Range Select	: 1.6 - 1.8 MHz
PA Bias Control	: MID TRAVEL
Standby Pushbutton	: OFF (released)
EHT Pushbutton	: OFF (released)
Control Extended Pushbutton	: OFF (released)
Metering Switch	: +28V

(9) Set the controls and switches of the MA 1720 as follows:

Output	: MUTE
Standby	: OFF (released)
EHT	: OFF (released)
Control	: LOCAL SYNTH
Mode	: SSB SUPP
USB/LSB	: USB
VOX/PTT/TX	: TX
METER	: RF
FREQUENCY	: 5.0000 MHz

Supply Checks

13. (1) Close the RF Compartment door and set the main supply switch to ON. Set the Cabinet Master switch to ON. Ensure that the SUPPLY indicator on control unit glows.

(2) Select STANDBY on the control unit. Ensure that the following occurs:

(a) The STANDBY pushbutton glows on Control Unit.

(b) Solenoids engage in the RF Compartment

(c) Neons glow on the Thyristor Decoder Card (in the Control Unit).

(3) Check that the control unit meter indicates +28 V ± 1 V.

(4) Using the digital multimeter set for d.c. volts, ensure that the +12 V supply at test point TP 1 on the ALC board is +12 V ± 0.6 V (TP 3 is 0 V connection).

(5) Using the digital multimeter, set for d.c. volts, ensure that the -12 V supply at test point TP2 on the ALC board is -12 V ± 0.6 V.

(6) Using the digital multimeter, set for d.c. volts, ensure that the +28 V supply at test point TP4 on the ALC board is +28 V ± 0.5 V

(7) Release the STANDBY pushbutton.

Setting-Up the TUNE and LOAD Coils

14. (1) ENSURE THAT THE EHT FUSE IS REMOVED FROM ITS PANEL HOLDER.

(2) Remove the RF Compartment front panel to expose the coil assemblies.

(3) Using the edge-wheels set each coil to its maximum inductance position, (i.e. rotors at the bottom).

(4) Using a separate key, set the TA 1823 Cabinet Master switch to ON. (See WARNING above).

(5) Loosen the three screws securing R1 on the left hand coil assembly and attach the multimeter, set to d.c. volts, to monitor the wiper to earth voltage. Rotate the potentiometer for a reading of
CC68752 +5 V ± 0.5 V. Tighten the screws ensuring the reading is not changed. Check that the Control Unit meter in the Load position indicates nearly FSD.

(6) Set the left hand coil assembly to its minimum inductance (ie rotor at the top). Check that the multimeter now indicates -5 V ± 0.5 V.

(7) Repeat operations (5) and (6) for the right-hand coil assembly, with the control unit meter in the Tune position.

(8) Set the Cabinet Master switch to EHT SHORTED using the separate key.

Manual Range Selection ~~and Tune/Ready~~ Checks

15. (1) Close the RF Compartment door. Release the STANDBY pushbutton.

(2) Set the Cabinet Master switch to ON. Select the STANDBY position and check that the blower now operates and that no air failure indication occurs after 20 seconds or so. Release the STANDBY pushbutton.

(3) Set the MANUAL RANGE SELECTION switch to each position in turn and check that the solenoids in the RF unit and the neons on the Thyristor Decoder Card in the Control Unit operate as detailed in the following table:-

Note: The RF unit solenoids are numbered as follows:-

Anode Decoupling solenoid	RLC
Top row capacitors, front to back	RLD, E, F, G, H, J
Bottom row capacitors, front to back	RLK, L, M, N, P, R
Tune coil shorting	4 RLA
Load coil shorting	5 RLA

The neons are numbered LP1 to LP11, starting at the bottom edge of the Card.

Table 1 Neons and Solenoids Engaged

Frequency Range	Neons Activated	Solenoids Operated
1.6 - 1.8 MHz	LP- 3, 4, 5, 6, 8	RL- E, G, H, J, M, N, P, R
1.8 - 2.71	LP- 3, 4, 5, 7	RL- G, H, K, N, R, E
2.71 - 4.05	LP- ~~2~~ 5	RL- H, R
4.05 - 6.04	LP- 2, 3, 4, 9	RL- E, F, G, L, N
6.04 - 9.02	LP- 4, 7, 9, 11	RL- C, G, K, L
9.02 - 13.47	LP- 1, 2, 9, 11	RL- C, D, F, L
13.47 - 20.1	LP- 1, 7, 8, 10, 11	RL- C, D, K, M, 4 RLA, 5 RLA
20.1 - 30.0	LP- 7, 10, 11	RL- C, K, 4RLA, 5 RLA

Auto Range Selection Checks

16. (1) Reset the Manual Range Switch to AUTO. On the cabinet set the mains switch to ON. Select STBY ON.

(2) Set the MA 1720 Drive Unit to 1.61 MHz, TUNE, and set the level of output to approx 100 mW. (2.25 V to 50 Ω). Connect to the TA 1823 input.

(3) Press the RESET button on the Control Unit, and check that the neons appropriate to the input frequencies glow on the Thyristor Decoder Card. (See Table 1) and that the TUNE and LOAD coils settle near to the LF (bottom) end of their travel.

2,3,5,7,11,15,25
CR 68762

(4) Repeat operation (3) for the following signal frequencies: ~~1.79 MHz~~, ~~1.81 MHz~~, 2.70 MHz, ~~4.04 MHz~~, 4.06 MHz, 6.03 MHz, 6.05 MHz, ~~9.01 MHz~~, 9.03 MHz, ~~13.46 MHz~~, ~~13,48 MHz~~, ~~20.09 MHz~~, ~~20.11 MHz~~, ~~29.99 MHz~~. At 13.48 MHz and higher frequencies the TUNE and LOAD coils should settle immediately above the upper shorting contact.

(5) Switch OFF.

EHT Delay Check and Bias Setting Up

17. (1) Set the Cabinet Master switch to EHT SHORTED. Replace the front panel of the RF door. Remove the access covers for manual operation. Replace the EHT Supply fuse in its holder. Close the door.

~~(2) Connect the test gear as in Fig 12.7.~~

(3) Set the Mains Switch to ON. Select STANDBY, then select EHT. Check that the EHT pushbutton flashes on an off.

(4) Release the STANDBY pushbutton. Depress the STANDBY pushbutton and start the stopwatch. Stop the watch when the EHT lamp stops flashing and remains illuminated. Ensure that the time interval is between 3 and 4 minutes.

(5) Set the control unit Meter Switch to Ik. Adjust the PA Bias Control as necessary for Ik = 300 mA.

(6) Wait for about 3 minutes for any further warm-up of the PA valve to take place. Then readjust bias level for 300 mA if necessary.

(7) Set the Cabinet Master switch to EHT SHORTED.

Setting-Up Input Matching

18. (1) Remove the EHT and Heater supply fuses from their holders on the Switch and Fuse Panel.

(2) Swing open the RF Compartment to gain access to the input matching board in the valve grid compartment. Use a piece of masking tape (or similar) to set the FAN FAIL microswitch to its Airflow-Normal position.

(3) Disconnect the RF input lead to the input matching circuits at SK2 on the Drive Amplifier and connect test equipment as shown in Fig. 12.2.

(4) Set the mains supply switch to its ON position, and select STANDBY on the control unit pushbutton.

(5) Substitute a 2.0 : 1 mismatch load for the TA 1823 input matching network input to the protector. Adjust the POLYSKOP to display 1.6 MHz to - 10 MHz in one sweep and set the gain to put the channel 1 trace from the Rhotector at about 1/3 screen height. Use channel 2 trace set to EMF as a marker at this level.

(6) Reconnect the Input Matching network in place of the 2.0:1 mismatch load. Switch ON the mains supply to the TA 1823 using the separate key. Set the TA 1823 MANUAL RANGE SELECTION switch to 1.6 - 1.8 MHz.

(7) Adjust the core of L5 on the Input Matching Board to provide the lowest possible output trace on channel 1 over the 1.6 mHz to 10 MHz frequency range. Ensure that it is below the marker line established in operation (5) at all points.

(8) Set the MANUAL RANGE SELECTION switch to each of the frequency ranges below 10 MHz and ensure that the trace displayed on the Polyskop is the same on each range.

(9) Reset the Polyskop using the procedure in operation (5) but for a frequency range of 9 MHz to 20 MHz.

(10) Reconnect the input matching network to the Rhotector, and set the TA 1823 MANUAL RANGE SELECTION switch to the 9.02 - 13.47 MHz range.

(11) Adjust the cores of L2, L4, L7 as necessary to gain the lowest possible output trace between 9 MHz and 20 MHz. Ensure that it is below the marker line established in operation (9) at all points.

(12) Set the MANUAL RANGE SELECTION switch to the 13.47 to 20.1 MHz range and check that the Polyskop trace remains the same as in operation (11).

(13) Reset the Polyskop using the procedure given in operation (5) for a frequency range of 20 MHz to 30 MHz.

(14) Reconnect the input matching network to the Rhotector and set the TA 1823 MANUAL RANGE SELECTION switch to the 20.1 to 30 MHz range.

(15) Adjust the courses of L1, L3, L6 as necessary to gain the lowest possible output trace between 20 and 30 MHz. Ensure that it is below the marker line established in operation (13) at all points.

(16) Repeat operations (6) to (15) with the Heater supply fuse in position, allow the valve 3 mins to warm up and then retrim each range quickly to prevent overheating of the valve.

(17) Switch OFF. Disconnect the test gear of Fig. 12.2 and reconnect the RF input to the Input Matching Board of the Drive Amplifier SK1.

(18) Remove the tape securing the FAN FAIL microswitch. Switch ON again.

(19) Check that the AIR FAIL indicator (on the Control Unit) glows when the switch is pushed back against the airflow, and that the STANDBY lamp is extinguished.

(20) Switch OFF again.

<u>ALC Level settings</u>

19. (1) Set the MANUAL RANGE SELECTION Switch to the 4.05 - 6.04 MHz range. Set the MANUAL ALC LEVEL Switch to TUNE. Set the Control Unit meter to Ik. On the ALC Card, set R31, R32 anticlockwise and R15 clockwise.

(2) Apply a drive signal at 5.0 MHz CW to the TA 1823 via the variable attenuator, gradually increasing the level until Ik = 420 mA is indicated on the control unit meter.

(3) Connect the digital voltmeter to monitor the voltage across R53 on the ALC Card. Adjust R38 until the Ik reading just starts to fall. Note the reading on the voltmeter, and reduce it by 0.6 V by further adjustment of R 38. Check that the Ik reading is once more 420 mA.

(4) Adjust R 32 on the ALC Card until the Ik reading is 400 mA. Increase the drive level and check that no change occurs in the Ik reading. Back the drive off to the 400 mA Ik level.

(5) Set both the TUNE and LOAD coils to the LF end (wipers at bottom).

(6) Set the control unit meter to RFVa. Adjust the TUNE coil in the HF direction until the meter indicates 4.8 kV, or as high as possible. If less than 4.8 kV, adjust R15 on the ALC Card until the RFVa reading is 4.75 kV.

(7) Adjust the LOAD coil in the HF direction until the RFVa reading drops to about 1.25 kV. Then adjust simultaneously the TUNE coil for Peak Va and the LOAD coil for 1.25 kV Va. Continue until the peak obtainable is 1.25 kV.

(8) Set the Control Unit meter to Ik.

(9) Set the MAN. ALC LEVEL switch to OPERATE. Increase the drive level until 660 mA Ik is indicated. Adjust R31 on the ALC board to reduce this to 650 mA.

altered CR 68724.

* (10) Readjust the TUNE and LOAD coils if necessary for Va peak of 4.5 kV. Check that the Output Power from the Amplifier is between 1000 and 1200 Watts.

* (11) Set the control unit meter to FWD PWR. Adjust R6 on the ALC Board for a meter reading corresponding to the output figure as operation (10).

(12) Reduce the drive until the output power is 200 watts. Set SA on the ALC Card to SET. Set Control Unit Meter to REF PWR. Adjust R7 on the ALC Card for a reading of 200 W.

(13) Reduce the drive input to give 100 W output level. Note the reading on the Control Unit meter.

(14) Readjust R7 at 100 W and 200 W levels for best compromise meter reading at both levels.

(15) Increase the drive level until the VSWR trip operates. Check that this occurs between 250 and 350 Watts.

(16) Reset SA to NORMAL.

(17) Reset the VSWR trip, and set the Control Unit meter to read Ik.

(18) Increase the drive input to give Ik reading on Control Unit meter of 600 mA.

(19) Manually offset the TUNE coil until the output power falls towards 300 watts. Ensure that between 250 and 350 watts the amplifier MISTUNED trip operates. Note the level at which tripping took place.

(20) Set the ALC switch to TUNE. Reset the MISTUNED trip. Readjust the TUNE coil for max output.

(21) Reset the ALC switch to OPERATE. Reduce drive to give ~~550~~ 500 mA Ik.

CR68752

(22) Offset the TUNE coil again to reduce the output level to below that noted in operation (19). The MISTUNE Trip should not operate.

(23) Retune the TUNE coil to peak output.

(24) Mute the drive signal. Switch off the EHT, STANDBY, and Cabinet Master switches.

Discriminator setting

20. (1) Replace the ALC Card in the Control Unit, then use the extender card to extend the Servo Preamplifier Card.

(2) Switch on the cabinet mains supply, then select STANDBY and EHT. Set the MANUAL ALC switch to TUNE. Demute the drive signal.

(3) Recheck tuning of the Power Amplifier first at 400 mA Ik for 1.25 kV RFVa.

(4) Set the MANUAL ALC switch to OPERATE and check the tuning (at 650 mA Ik for 4.5 kV RFVa.) as at 19-10.

(5) Reset the MANUAL ALC switch to TUNE.

(6) Using the digital voltmeter set for d.c. volts, adjust R2 for zero volts between TP1 TUNE and 0 V and R63 for zero volts between TP7 LOAD and 0 V.

(7) Mute the drive signal, and set the MANUAL RANGE switch to AUTO.

(8) Demute the drive and operate the RESET button on the Control Unit. Ensure that the following events takes place:-

(a) The neons appropriate to 5 MHz glow on the Thyristor Decoder Card.

(b) The relevant solenoids operate in the RF Compartment.

(c) The TUNE and LOAD coils run to their coarse-tune positions.

(d) The TUNE coil runs in an HF direction and then locks on to the discriminator output.

(e) The TUNE and LOAD coils run together, then stop at the correct tuning positions.

(f) READY is signalled on the Control Unit.

(9) Check that Ik is now (~~650 mA~~ as 19-10) and that Power Output and RFVa are within 5% of the values previously noted.

Cabinet VSWR Unit setting

21. (1) Retune the drive source and the Power Amplifier to 10 MHz.

(2) Set the Control Unit meter to REF PWR and adjust C3 in the cabinet VSWR unit for minimum meter deflection.

(3) Mute the Drive Unit.

22. CW Power Output Measurement

(1) Ensure that the TA 1823 and test equipment are connected as in Fig 12.5, General Test Set Up.

(2) Set the TA 1823 Cabinet Master switch to ON. Set the CONTROL EXTENDED push button to ON, set the MANUAL RANGE SELECTION switch to AUTO.

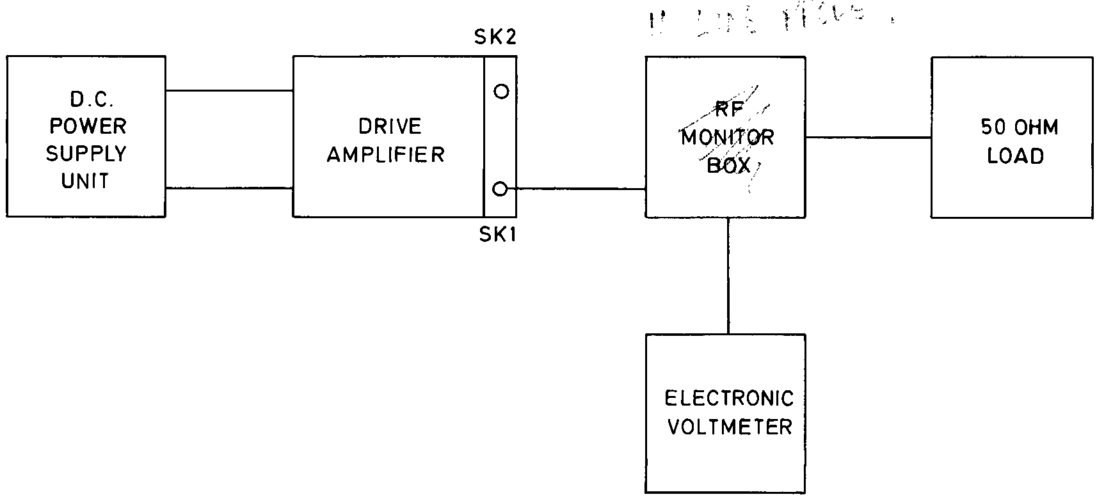
(3) Set the MA 1720 to TUNE. Select STANDBY and EHT at the MA 1720.

(4) When the TA 1823 EHT comes on, tune the TA 1823 automatically at the following frequencies:- 1.6, 2, 3 MHz etc to 29.99 MHz. Check that in each case the Power Output is not less than 800 W.

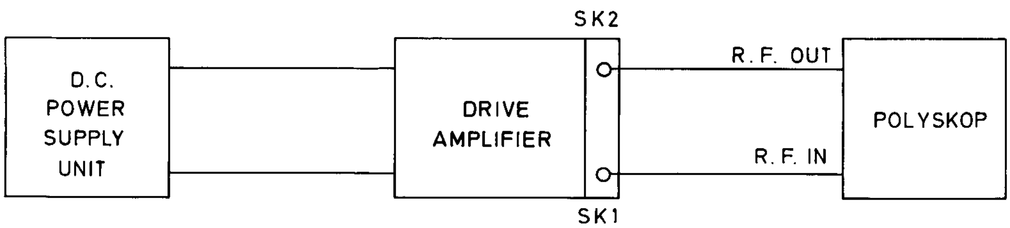
23. Tuning Time

(1) Tune the system to 30 MHz. Select 13.3 MHz at the MA 1720. Using a stop watch, time the interval between pressing RESET on the MA 1720 and obtaining READY indications on the TA 1823 and MA 1720. This should be less than 10 seconds.

(2) Switch OFF all equipment and disconnect the test gear from the TA 1823.



Quiescent Current Setting   Fig. 12.1



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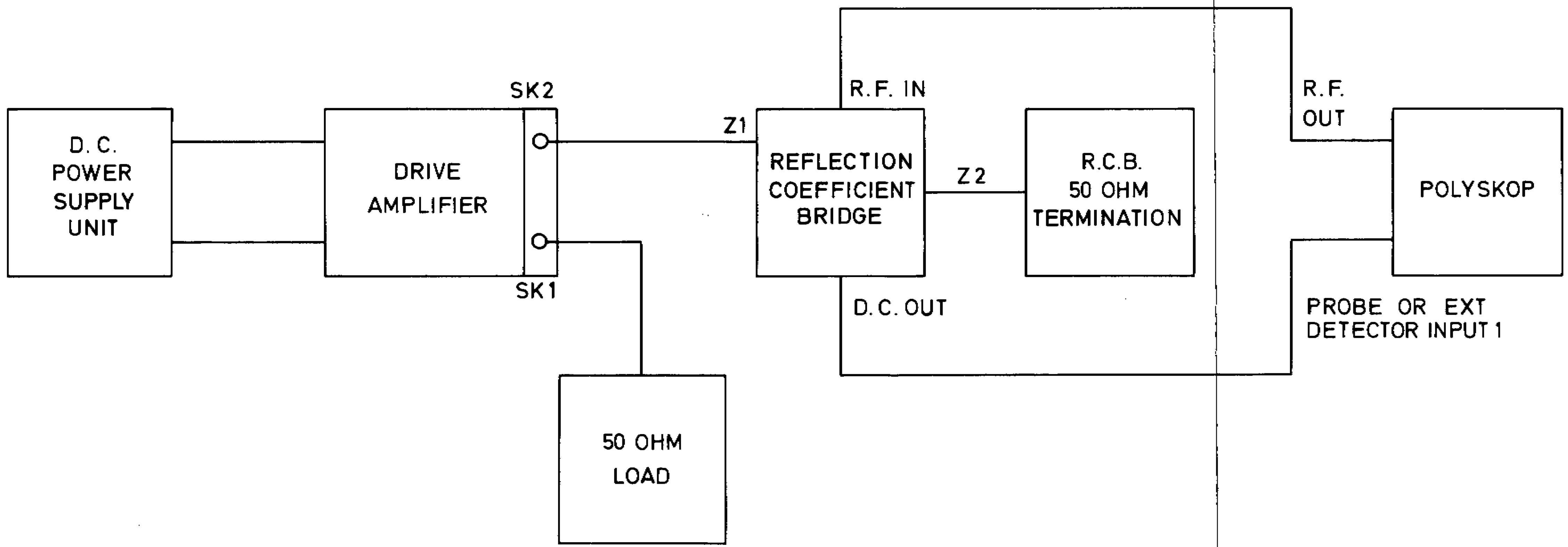
R F Gain Test   Fig. 12.2



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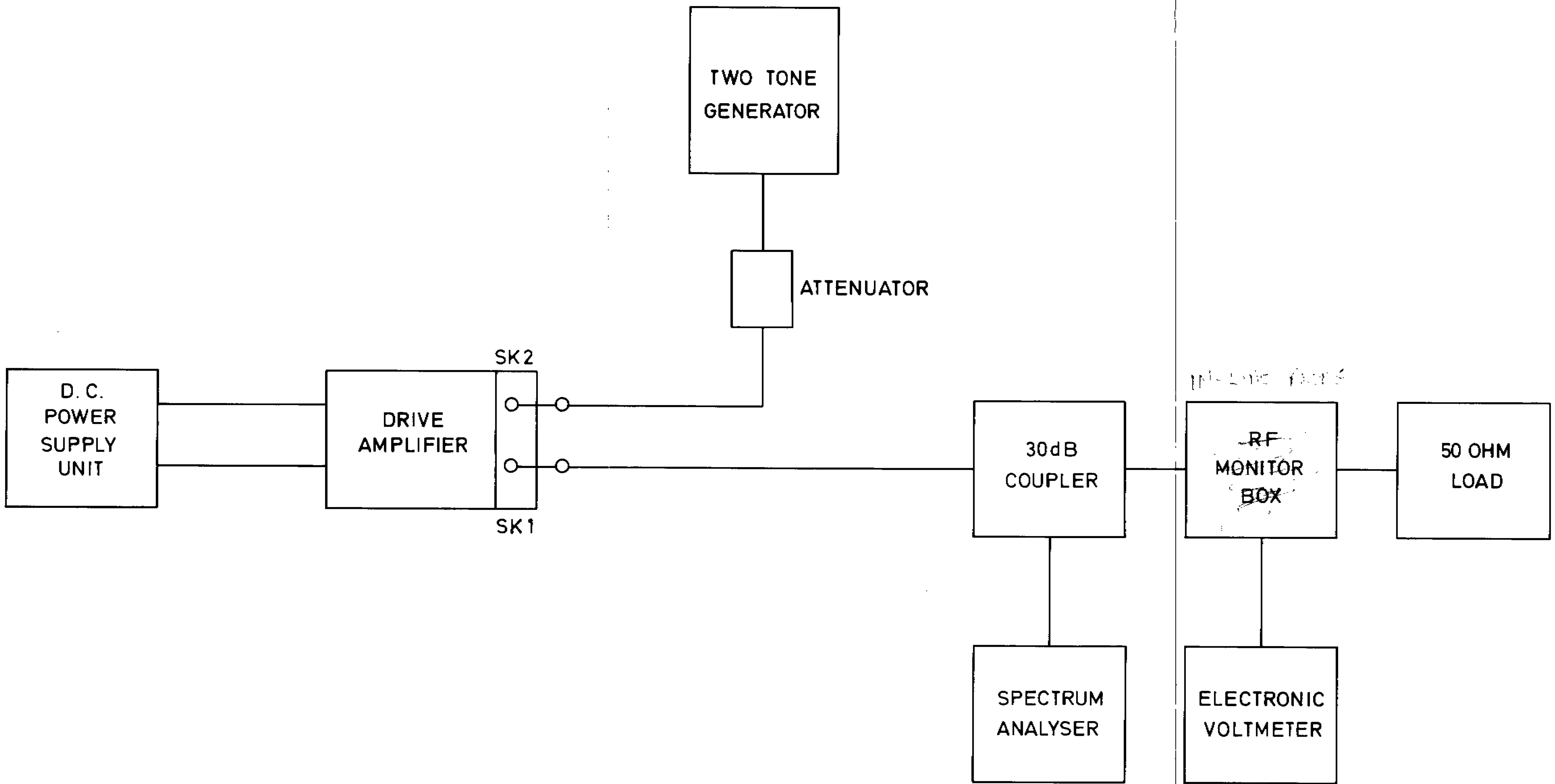
Input V.S.W.R. Test Fig.1



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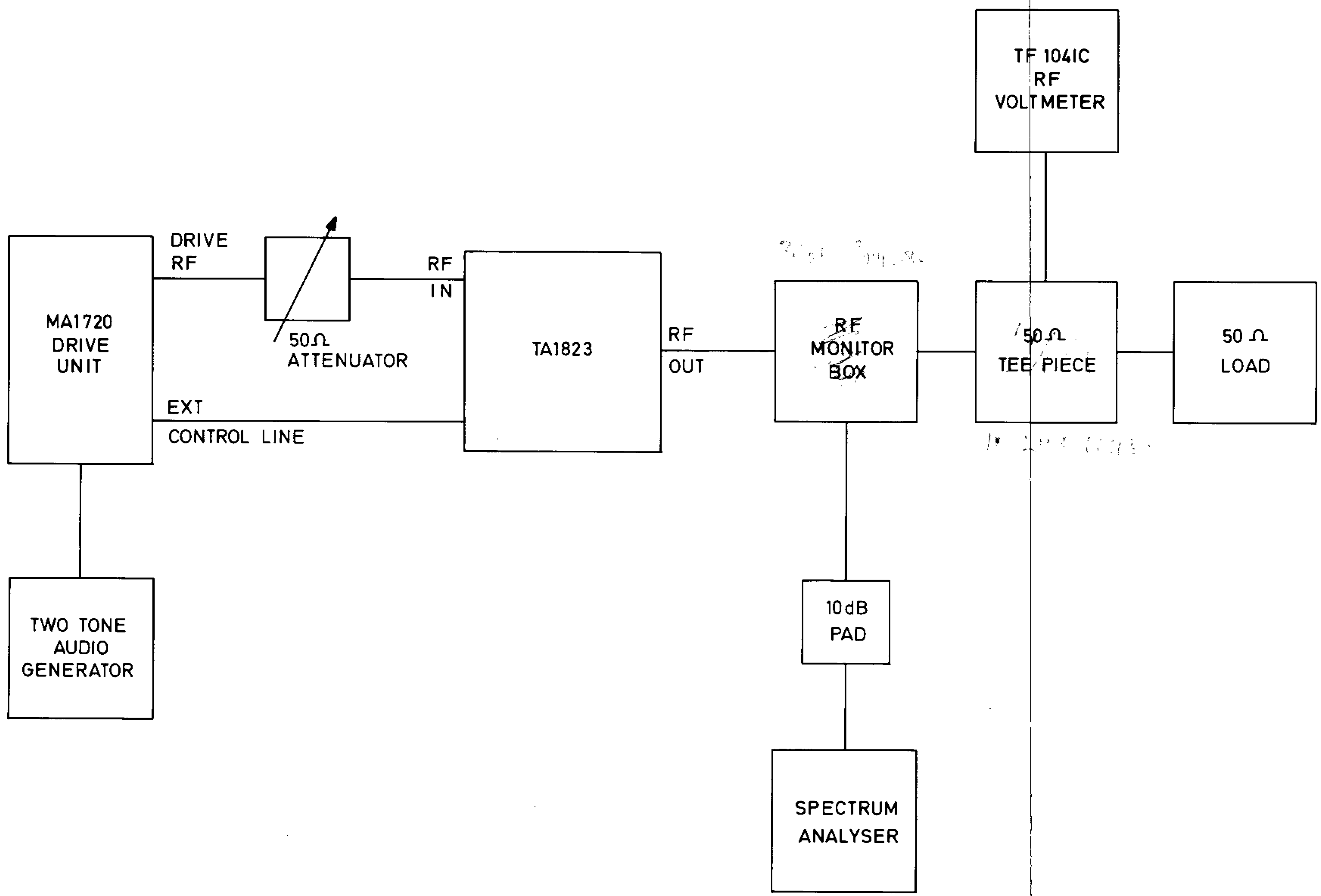
Muting Fig. 12



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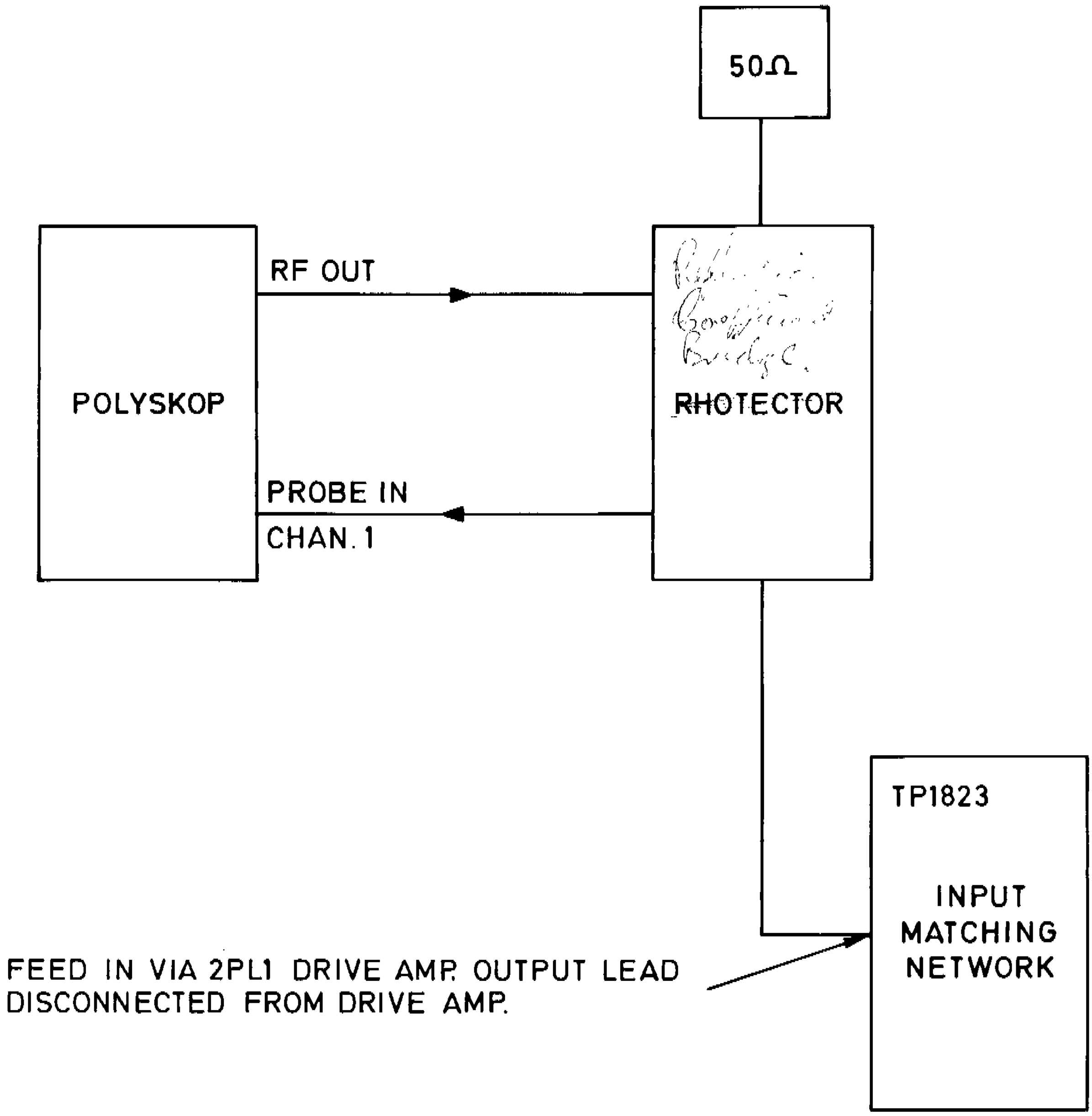
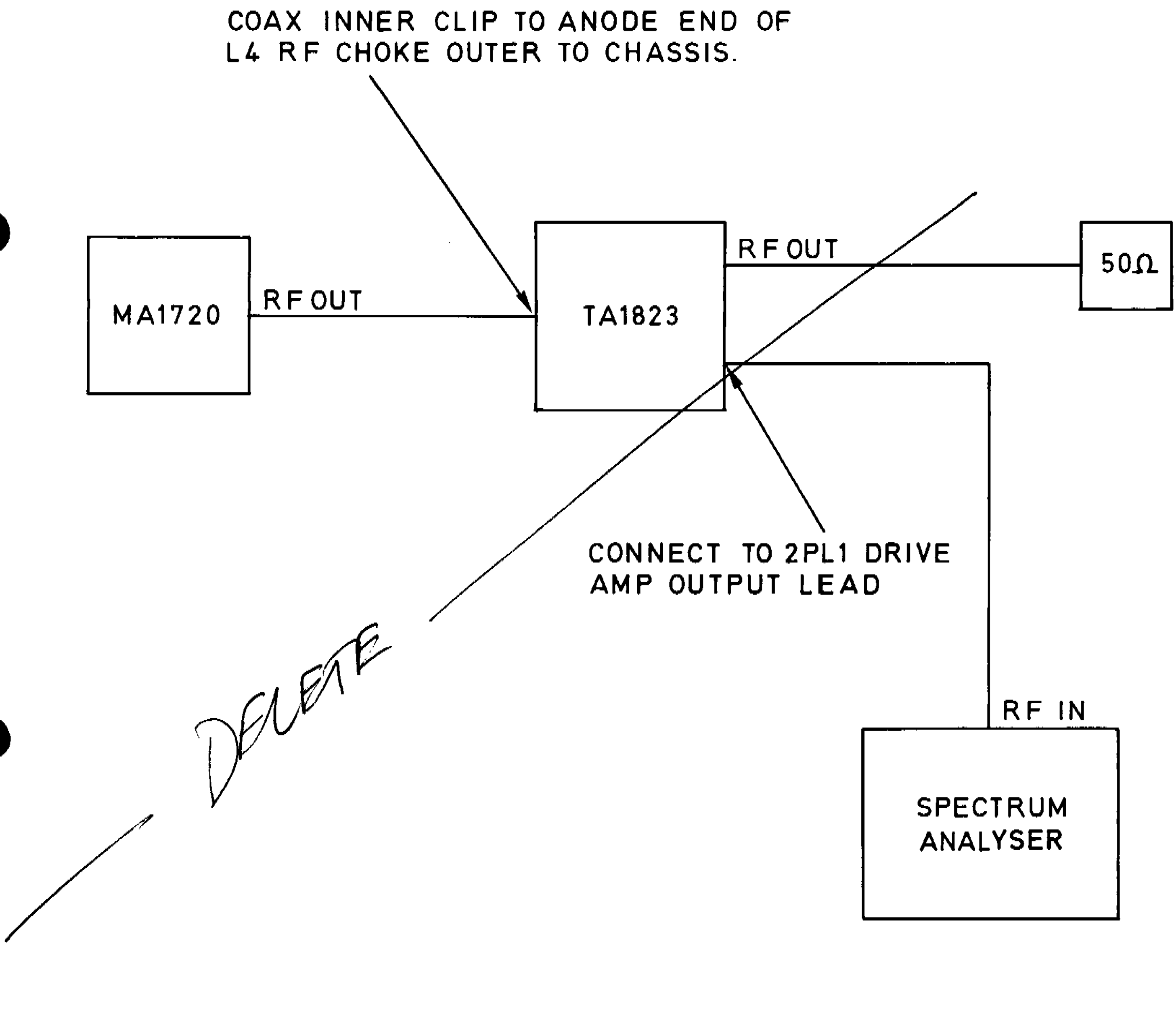
General Test Set Up Fig.1



Input Matching : Setting Up Network Fig. 12.6



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~~EHT Delay Check and Bias Setting~~ Fig. 12.7

CHAPTER 13

COMPONENTS LISTS

CONTENTS

Item No	Description	Racal Part Number
	1 KW LINEAR AMPLIFIER CABINET	
1	Manual Override Board	ST80447
2	EHT Monitoring Board	ST80457
3	Auxiliary Power Supply Board	ST80461
4	Amplifier Discriminator Board	ST80525
5	Phase Discriminator Board	ST80527
6	Control Unit	ST80551
7	Input Matching Board	ST80881
8	Coil Assy Tune	ST81315
9	Coil Assy Load	ST81316
10	Drive Amplifier Assy	ST81549
11	Switched Mode Power Supply	ST81574

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

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Resistors

Cct Ref	Ohms	Description	W	Tol %	Racal Part Number
R1	1 k	Variable			919050
R2	560	Metal Oxide		2	909772
R3	1 k			2	939256
R4	10	Metal Oxide		2	918729
R5	10	Metal Oxide		2	918729

Capacitors

Cct Ref	μF	Description	V	Tol %	Racal Part Number
C1	250 n	Plastic Film		10 k	939123
C2		Special			CD81010
C3	15	Electrolytic	63	+50 -10	930588
C4	10	Electrolytic	40	+50 -10	919351
C5	10	Electrolytic	40	+50 -10	919351
C6	100 n	Polyester	100	20	930801
C7	100 n	Polyester	100	20	930801
C8	1 n	Ceramic Feed Thro	500	+80 -20	907011
C9	1 n	Ceramic Feed Thro	500	+80 -20	907011
C10	100 n	Polyester	100	20	930801
C11	1	Polycarbonate	100	10	931133
C12	1 n	Ceramic Feed Thro	500	+80 -20	907011
C13	100 n	Polyester	100	20	930801
C14	100 n	Polyester	100	20	930801
C15	1 n	Ceramic Feed Thro	500	+80 -20	907011
C16	1	Polycarbonate	100	10	931133
C17	100 n	Polyester	100	20	930801
C18	1 n	Ceramic Feed Thro	500	+80 -20	907011
C19	1 n	Ceramic Feed Thro	500	+80 -20	907011
C20	10 n	Ceramic Disc	4 k	5	937535
C21	10 n	Ceramic Disc	4 k	5	937535
C22	10 n	Ceramic Disc	4 k	+50 -25	926360
C23	1 n	Ceramic Feed Thro	500	+80 -20	907011
C24	10 n	Ceramic Disc	4 k	5	937535
C25	20 p	Ceramic Disc	5 k	5	937525
C26	20 p	Ceramic Disc	5 k	5	937525
C27	25 p	Ceramic Disc	7.5 k	5	937536
C28	25 p	Ceramic Disc	7.5 k	5	937536
C29	91 p	Ceramic Disc	6 k	5	937529
C30	240 p	Ceramic Disc	5.5 k	5	937532

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capacitors (Cont'd)					
	μF		V		
C31	200 p	Ceramic Disc	5.5 k	5	937530
C32	47 p	Ceramic Disc	5 k	5	937528
C33	91 p	Ceramic Disc	6 k	5	937529
C34	91 p	Ceramic Disc	6 k	5	937529
C35	39 p	Ceramic Disc	5 k	5	937527
C36	220 p	Ceramic Disc	5 k	5	937531
C37	470 p	Ceramic Disc		5	938762
C38	270 p	Ceramic Disc	5.5 k	5	937533
C39	330 p	Ceramic Disc	5.5 k	5	937534
C40	3	Part of BL1			
Transformers					
T1		EHT			DT81161
T2		Heater			CT81289
T3		Auxiliary			CT81288
Inductors					
L1		Choke Assy			DT81162
L2		Choke Assy			AT81382
L3		Choke Assy			AT81379
L4		Choke Assy			AT81381
L5		Choke Assy			AT81380
Diodes					
D1		Rectifier SDHD 10 k			937538
D2		Rectifier SDHD 10 k			937538
D3		Rectifier SDHD 10 k			937538
D4		Rectifier SDHD 10 k			937538
D5		1N 4006			925856
D6		1N 4006			925856
D7		Rectifier SCBA 1			928042
D8		Rectifier SCBA 1			928042
D9		Zener Z3B56R			937540
D10		Zener Z3B56R			937540

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes (Cont'd)					
D11		Zener Z3B56R			937540
D12		Zener Z3B56R			937540
D13		Zener Z3B5			937539
Transistors					
TR1		TIP 640			937343
TR2		TIP 645			937338
TR3		TIP 640			937343
TR4		TIP 645			937338
Connectors					
SK1		Socket, N Type, UG58A/U			937537
SK2		Socket, Coax BNC			906125
		Plug 37 Way DC37P			916507
		Socket 37 Way DC37S			915656
		Socket 9 Way DE95			918090
		Plug Elbow BN7/5			905031
		Plug Elbow 'N' Type 82GB574-4			928322
		Plug UG88/U			900038
		Plug CE91			937508
Miscellaneous					
RLA		Relay 24 V 628S-340-AS-24			938075
RLB		Relay 12 V KMK32			939104
RLC		Solenoid Assy			AA607695
RLD		Solenoid Assy			AA607695
RLE		Solenoid Assy			AA607695
RLF		Solenoid Assy			AA607695
RLG		Solenoid Assy			AA607695
RLH		Solenoid Assy			AA607695
RLJ		Solenoid Assy			AA607695
RLK		Solenoid Assy			AA607695

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Miscellaneous (Cont'd)					
RLL		Solenoid Assy			AA607695
RLM		Solenoid Assy			AA607695
RLN		Solenoid Assy			AA607695
RLP		Solenoid Assy			AA607695
RLR		Solenoid Assy			AA607695
TB1		Terminal Strip 4 Way			901468
TB2		Terminal Strip 4 Way			924734
TB3		Terminal Strip 12 Way			921428
TB4		Terminal Strip 12 Way			921428
TB5		Terminal Strip			AD80663
TB6		Terminal Strip 12 Way			921428
TB7		Terminal Strip 12 Way			921768
TB8		Terminal Strip 12 Way			921768
TB9		Terminal Strip 12 Way			921428
TB10		Terminal Strip 12 Way			921728
S1		Mains Switch			BA81799
S2		Wafer Switch 1 Pole 9 Way			BSW81903
S3		Switch Lever Sub-Miniature			923808
S4		Airflow Switch			CD606435
V1		Valve EIMAC			937523
BL1		Centrifugal Fan			CD80144
TP1		Terminal L1361/102			916413
FS2	1 A	Fuselink			928133
FS3	4 A	Fuselink			939258
FS1	30 A	Fuselink			937547

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

DRIVE AMPLIFIER ASSEMBLY

Transistors

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
*TR1		RF Power			AD81918
TR2		2N 3553			916730
*TR3		RF Power			AD81919
*TR4		RF Power			AD81919
*TR5		RF Power			AD81918
TR6		2N 2553			916730
TR7		BD 645			927472
TR8		BD 645			927472
TR9		BD 135			928104
TR10		BD 135			928104

*TR1, TR3, TR4, TR5 supplied as matching pairs

Connectors

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
PL1		Plug 9 Way DE9P			915643
SK1		Socket BNC COAX			923160
SK2		Socket BNC COAX			923160

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		DRIVE AMP BOARD			
Resistors					
	Ohms		W		
R1	10	Metal Oxide		2	920736
R2	33	Metal Oxide		2	920592
R3	10	Metal Oxide		2	920736
R4	10	Metal Oxide		2	920736
R5	320	Metal Oxide		5	919313
R6	10	Metal Oxide		2	920736
R7	1.0	Metal Oxide		2	938780
R8	10	Metal Oxide		2	920736
R9	10	Metal Oxide		2	920736
R10	47	Metal Oxide		2	918744
R11	1.0	Metal Oxide		2	938780
R12	10	Metal Oxide		2	920736
R13	100	Metal Oxide		2	910388
R14	1.0	Metal Oxide		2	938780
R15	1.0	Metal Oxide		2	938780
R16	1.0	Metal Oxide		2	938780
R17	1.0	Metal Oxide		2	938780
R18	10	Metal Oxide		2	920736
R19	1.0	Metal Oxide		2	910388
R20	1.0	Metal Oxide		2	938780
R21	10	Metal Oxide		2	920736
R22	47	Metal Oxide		2	918744
R23	10	Metal Oxide		2	920736
R24	1.0	Metal Oxide		2	938780
R25	10	Metal Oxide		2	920736
R26	220	Metal Oxide		5	919313
R27	10	Metal Oxide		2	920736
R28	33	Metal Oxide		2	920592
R29	10	Metal Oxide		2	920736
R30	47	Wire Wound		5	913694
R31	10	Metal Oxide		2	920736
R32	10	Metal Oxide		2	920736
R33	10	Metal Oxide		2	920736
R34	100	Variable			923661
R35	180	Wire Wound		5	913680

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Resistors (Cont'd)					
	Ohms		W		
R36	100	Variable			923661
R37	22	Metal Oxide		2	920743
R38	35	Wire Wound		5	913827
R39	82	Metal Oxide		2	917057
R40	2.2 k	Metal Oxide		2	910984
R41	3.3 k	Metal Oxide		2	910111
R42	1 k	Metal Oxide		2	907731
R43	1 k	Metal Oxide		2	913489
R44	4.7 k	Metal Oxide		2	913490
R45	1.5 k	Metal Oxide		2	907730
R46	1 k	Metal Oxide		2	913489
R47	6.8 k	Metal Oxide		2	910112
R48	4.7 k	Metal Oxide		2	913490
R49	47 k	Metal Oxide		2	913496
R50	27 k	Metal Oxide		2	913494
R51	33 k	Metal Oxide		2	913495
R52	47	Metal Oxide		2	917063
Capacitors					
	μF		V		
C1	100 n	Ceramic	50	20	938786
C2	100 n	Ceramic	50	20	938786
C3	470 p	Ceramic Disc	500	10	917453
C4	100 n	Ceramic Disc	30	+50 -25	928116
C5	100 n	Ceramic Disc	30	+50 -25	928116
C6	470 p	Ceramic Disc	500	10	917453
C7	10 n	Ceramic Disc	250	+40 -20	916187
C8	100 n	Ceramic Disc	30	+50 -25	928116
C9	100 n	Ceramic Disc	30	+50 -25	928116
C10	100 n	Ceramic Disc	30	+50 -25	928116
C11	100 n	Ceramic Disc	30	+50 -25	928116
C12	33 p	Ceramic Disc	500	10	914909
C13	4.7 n	Ceramic Disc	50	10	939124
C14	100 n	Ceramic Disc	30	+50 -25	928116
C15	10 n	Ceramic Disc	250	+40 -20	916187

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capacitors (Cont'd)					
	µF		V		
C16	100 n	Ceramic Disc	30	+50 -25	928116
C17	100 n	Ceramic Disc	30	+50 -25	928116
C18	4.7 n	Ceramic Disc	50	10	939124
C19	100 n	Ceramic Disc	30	+50 -25	928116
C20	10 n	Ceramic Disc	250	+40 -20	916187
C21	100 n	Ceramic Disc	30	+50 -25	928116
C22	470 p	Ceramic Disc	500	10	917453
C23	10 n	Ceramic Disc	250	+40 -20	916187
C24	100 n	Ceramic Disc	30	+50 -25	928116
C25	470 p	Ceramic Disc	500	10	917453
C26	100 n	Ceramic Disc	30	+50 -25	928116
C27	100 n	Ceramic	50	30	938786
C28	100 n	Ceramic	50	20	938786
C29	100 n	Ceramic Disc	30	+50 -25	928116
C30	10	Electrolytic	25	+50 -10	921518
C31	100	Electrolytic	10	+50 -10	921530
C32	100 n	Ceramic Disc	30	+50 -25	928116
C33	10 n	Ceramic Disc	250	+40 -20	916187
C34	10 n	Ceramic Disc	250	+40 -20	916187
C35	10 n	Ceramic Disc	250	+40 -20	916187
C36	100 n	Ceramic Disc	30	+50 -25	928116
C37	470 n	Polyester	100	20	917452
C38	100 n	Ceramic Disc	30	+50 -25	928116
C39	100 n	Ceramic Disc	30	+50 -25	928116
C40	10	Electrolytic	25	+50 -10	921518
Transformers					
T1					AT81376
T2					AT81376
T3					AT81377
T4					AT608094
T5					AT81388
T6					AT81378
T7					AT608093
T8					AT608091
T9					AT81377
T10					AT608094
T11					AT81376
T12					AT81376

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes					
D1		UM 9386			927908
D2		UM 9386			927908
D3		BZY 88-C6V2			911682
D4		BZY 88-C6V2			911682
D5		1N 4149			914898
D6		1N 4149			914898
Transistors					
TR1	-	(See page 13-6)			
TR2	-				
TR3	-				
TR4	-				
TR5	-				
TR6	-				
TR7	-				
TR8	-				
TR9	-				
TR10	-				
TR11		BFY 51			908753
TR12		BCY 71			911928
TR13		BC 107			911929
Ferrite Beads					
FX1		FX 1115			900461
FX2		FX 1115			900461
FX3		FX 1115			900461
FX4		FX 1115			900461
FX5		FX 1115			900461
FX6		FX 1115			900461
FX7		FX 1115			900461
FX8		FX 1115			900461
FX9		FX 1115			900461
FX10		FX 1115			900461
FX11		FX 1115			900461
FX12		FX 1115			900461
FX13		FX 1115			900461
FX14		FX 1115			900461
FX15		FX 1115			900461
FX16		FX 1115			900461

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		COIL ASSEMBLY TUNE			
Resistor					
	Ohms		W		
R1	10 k	Variable			932377
Miscellaneous					
RL1		Relay Rotary Solenoid NSF 2421BD			932575
TB1		Terminal Strip 12 Way			921768

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		COIL ASSEMBLY LOAD			
Resistor					
	Ohms		W		
R1	10 k	Variable			932377
Miscellaneous					
RL1		Relay Rotary Solenoid NSF 2421BD			932575
TB1		Terminal Strip 12 Way			921768

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

AUXILIARY POWER SUPPLY BOARD

Resistors

Cct Ref	Ohms	Description	W	Tol %	Racal Part Number
R1	68 k	Metal Oxide		2	920817
R2	390 k	Metal Oxide		2	928143
R3	2.7 k	Wire Wound	9	5	913780
R4	2.7 k	Wire Wound	9	5	913780
R5	27	Wire Wound	2.5	5	913582
R6	270 k	Metal Oxide		2	920826
R7	33 k	Metal Oxide		2	918442

Capactiors

Cct Ref	µF	Description	V	Tol %	Racal Part Number
C1	1	Tantalum	35	20	923571
C2	1	Tantalum	35	20	923571
C3	1	Tantalum	35	20	923571
C4	1	Tantalum	35	20	923571
C5	10	Electrolytic	250	+50 -20	926131
C6	10	Electrolytic	450	+50 -20	923687
C7	10	Electrolytic	450	+50 -20	923687

Diodes

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
D1		Bridge Rectifier OSH 01A200			928145
D2		1N 4006			925856
D3		1N 4006			925856
D4		1N 4006			925856
D5		1N 4006			925856

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Integrated Circuits					
ML1		Voltage Positive Regulator LAS 1512			929841
ML2		Voltage Negative Regulator LAS 1812			929842
Miscellaneous					
FS1	250 mA	Fuse Link			933504
FS2	250 mA	Fuse Link			933504
		Fuseholder L 1426			924594
		Heatsink TV3			928169

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		EHT MONITORING BOARD			
Resistors					
	Ohms		W		
R1	10	Wire Wound	12	5	913815
R2	10	Wire Wound	12	5	913815
R3	22 k	Metal Oxide		2	920811
R4	22 k	Metal Oxide		2	920811
R5	390 k	Metal Oxide		2	928143
R6	390 k	Metal Oxide		2	928143
R7	100	Carbon Comp	2	5	929696
R8	390 k	Metal Oxide		2	928143
R9	390 k	Metal Oxide		2	928143
R10	390 k	Metal Oxide		2	928143
R11	390 k	Metal Oxide		2	928143
R12	390 k	Metal Oxide		2	928143
Diodes					
D1		Zener Z3B10			937541
Miscellaneous					
SG1		Spark Gap B1/C90			938761

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

ALC CARD

Resistors

	Ohms		W		
R1	330	Metal Oxide		2	915690
R2	10 k	Metal Oxide		2	914042
R3	1 k	Metal Oxide		2	913489
R4	3.3 k	Metal Oxide		2	910111
R5	2.7 k	Metal Oxide		2	916548
R6	10 k	Variable			920312
R7	10 k	Variable			920312
R8	1 k	Metal Oxide		2	913489
R9	8.2 k	Metal Oxide		2	918202
R10	12 k	Metal Oxide		2	917952
R11	2.2 k	Metal Oxide		2	916546
R12	10 k	Metal Oxide		2	914042
R13	~~2.7 k~~ 4.7K	Metal Oxide		2	~~916548~~
R14	5.6 k	Metal Oxide		2	918128
R15	6.8 k	Metal Oxide		2	910112
R16	100 k	Metal Oxide		2	915190
R17	6.8 k	Metal Oxide		2	910112
R18	6.8 k	Metal Oxide		2	910112
R19	100 k	Metal Oxide		2	915190
R20	6.8 k	Metal Oxide		2	910112
R21	2.2 k	Metal Oxide		2	916546
R22	12 k	Metal Oxide		2	917952
R23	12 k	Metal Oxide		2	917952
R24	1 k	Metal Oxide		2	913489
R25	1 k	Metal Oxide		2	913489
R26	1.8 k	Metal Oxide		2	911148
R27	10	Metal Oxide		2	920736
R28	4.7 k	Variable			920311
R29	4.7 k	Variable			920311
R30	100 k	Metal Oxide		2	915190
R31	6.8 k	Metal Oxide		2	910112
R32	100 k	Metal Oxide		2	915190
R33	8.2 k	Metal Oxide		2	918202
R34	2.2 k	Metal Oxide		2	916546
R35	2.2 k	Metal Oxide		2	916546

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Resistors (Cont'd)					
	Ohms		W		
R36	5.6 k	Metal Oxide		2	918128
R37	470	Variable			920610
R38	33 k	Metal Oxide		2	913495
R39	10 k	Metal Oxide		2	914042
R40	27	Metal Oxide		2	911628
R41	10 k	Metal Oxide		2	914042
R42	1 k	Metal Oxide		2	913489
R43	12 k	Metal Oxide		2	917952
R44	100 k	Metal Oxide		2	915190
R45	1 k	Metal Oxide		2	913489
R46	680	Metal Oxide		2	910113
R47	680	Metal Oxide		2	910113
R48	82	Wire Wound	12	5	913837
R49	1 k	Metal Oxide		2	913489
R50	1 k	Metal Oxide		2	913489
R51	10 k	Metal Oxide		2	914042
R52	2.2 k	Metal Oxide		2	916546
Capacitors					
	μF		V		
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	100 n	Polycarbonate	100	10	931130
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067
C6	-				
C7	0.01	Ceramic Disc	250	+80 -20	900067
C8	100 n	Polycarbonate	100	10	931130
C9	-				
C10	-				
C11	0.01	Ceramic Disc	250	+80 -20	900067
C12	0.01	Ceramic Disc	250	+80 -20	900067
C13	-				
C14	100	Tantalum Electrolytic	20	10	913445
C15	-				
C16	0.01	Ceramic Disc	250	+80 -20	900067
C17	1 n	Ceramicon	500	20	915243
C18	1 n	Ceramicon	500	20	915243

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898
D5		BZY 88-C5V6			912747
D6		1N 4149			914898
D7		1N 4149			914898
D8		1N 4149			914898
D9		1N 4149			914898
D10		1N 4149			914898
D11		BZY 88-C2V7			932057
D12		1N 4149			914898
D13		1N 4149			914898
D14		1N 4149			914898
D15		1N 4149			914898
D16		1N 4149			914898
D17		1N 4149			914898
D18		1N 4149			914898
Transistors					
TR1		BC 107			911929
TR2		BC 107			911929
TR3		2N 2222A			910086
TR4		2N 2222A			910086
TR5		BFY 51			908753
TR6		BC 107			911929
TR7		BC 107			911929
TR8		BD 201			928106
Integrated Circuits					
ML1		Photo-transistor/Opto-isolator (MCT 2)			938840
ML2		Quad Operational Amp (CA 324E)			927613
ML3		Quad Operational Amp (CA 324E)			927613
ML4		Dual D-Type Flip Flop (CD 4013BE)			926860

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Miscellaneous					
SW1		Switch SDC1			934008
		14 Pin C83-14-02			930605
		Handle 21-1888G			938756

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		COUNTER CARD			
Resistors					
	Ohms		W		
R1	4.7 k	Metal Oxide		2	913490
R2	1 k	Metal Oxide		2	913489
R3	150	Metal Oxide		2	910389
R4	10 k	Metal Oxide		2	914042
R5	330	Metal Oxide		2	915690
R6	330	Metal Oxide		2	915690
R7	68 k	Metal Oxide		2	916478
R8	68 k	Metal Oxide		2	916478
R9	47 k	Metal Oxide		2	913496
R10	1 k	Metal Oxide		2	913489
R11	47 k	Metal Oxide		2	913496
R12	47 k	Metal Oxide		2	913496
R13	4.7 k	Metal Oxide		2	913490
R14	15 k	Metal Oxide		2	920645
R15	47 k	Metal Oxide		2	913496
R16	5.6 k	Metal Oxide		2	918128
R17	5.6 k	Metal Oxide		2	918128
R18	1.2 k	Metal Oxide		2	911179
R19	1 M	Metal Oxide		2	918121
R20	470	Metal Oxide		2	920758
R21	12 k	Metal Oxide		2	917952
R22	3.3 k	Metal Oxide		2	910111
R23	68 k	Metal Oxide		2	916478
R24	68 k	Metal Oxide		2	916478
R25	47 k	Metal Oxide		2	913496
R26	47 k	Metal Oxide		2	913496
R27	47 k	Metal Oxide		2	913496
R28	47 k	Metal Oxide		2	913496
R29	5.6 k	Metal Oxide		2	918128
R30	5.6 k	Metal Oxide		2	918128
R31	10 k	Metal Oxide		2	914042
R32	39 k	Metal Oxide		2	900993
R33	39 k	Metal Oxide		2	900993
R34	39 k	Metal Oxide		2	900993
R35	22 k	Metal Oxide		2	913493
R36	22 k	Metal Oxide		2	913493
R37	22 k	Metal Oxide		2	913493
R38	100 k	Network 10 Pin SIL			934589
R39	100 k	Metal Oxide		2	915190

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capacitors					
	µF		V		
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	150 p	Ceramic Disc	500	10	917742
C3	0.1	Polycarbonate	100	10	931130
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.1	Polycarbonate	100	10	931130
C6	330 p	Ceramic Disc	500	10	917738
C7	0.01	Ceramic Disc	250	+80 -20	900067
C8	0.01	Ceramic Disc	250	+80 -20	900067
C9	0.1	Polycarbonate	100	10	931130
Diodes					
D1		OA47			900069
D2		OA47			900069
Transistors					
TR1		BC107			911929
TR2		BC107			911929
TR3		BC107			911929
TR4		BC107			911929
TR5		BC107			911929
Integrated Circuits					
ML1		4 Bit Binary Counter (SN 74LS93)			931638
ML2		Voltage Regulator (78L05AHC)			926425
ML3		Quad Low to High Level Shifter (CD 40109BE)			931054
ML4		Quad 3 State NOR R/S Latch (CD 4043BE)			930855
ML5		Quad 2 Input NAND Gate (CD 4011BE)			930028

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Integrated Circuits (Cont,d)					
ML6		Quad 2 Input NAND Gate (CD 4011BE)			930028
ML7		Quad 2 Input NAND (SN 74LS00)			930049
ML8		Single 8 Channel Mux (CD 4051BE)			930035
ML9		14 Bit Ripple Counter (CD 4020BE)			930242
ML10		Single 8 Channel Mux (CD 4051BE)			930035
ML11		8 Bit Priority Encoder (CD 4232BE)			929702
Miscellaneous					
XL1		Crystal 1.28 MHz			AD 608460
		14 Pin DIL			930605
		16 Pin DIL			930606
		Transipad T05/001			916847
		Transipad T018/009			932515

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

THYRISTOR DECODER CARD

Resistors

	Ohms		W		
R1	100 k	Metal Oxide		2	915190
R2	100 k	Metal Oxide		2	915190
R3	12 k	Metal Oxide		2	917952
R4	12 k	Metal Oxide		2	917952
R5	12 k	Metal Oxide		2	917952
R6	22 k	Metal Oxide		2	913493
R7	22 k	Metal Oxide		2	913493
R8	22 k	Metal Oxide		2	913493
R9	22 k	Metal Oxide		2	913493
R10	22 k	Metal Oxide		2	913493
R11	22 k	Metal Oxide		2	913493
R12	22 k	Metal Oxide		2	913493
R13	22 k	Metal Oxide		2	913493
R14	22 k	Metal Oxide		2	913493
R15	22 k	Metal Oxide		2	913493
R16	22 k	Metal Oxide		2	913493
R17	4.7 k	Metal Oxide		2	913490
R18	4.7 k	Metal Oxide		2	913490
R19	4.7 k	Metal Oxide		2	913490
R20	4.7 k	Metal Oxide		2	913490
R21	4.7 k	Metal Oxide		2	913490
R22	4.7 k	Metal Oxide		2	913490
R23	4.7 k	Metal Oxide		2	913490
R24	4.7 k	Metal Oxide		2	913490
R25	4.7 k	Metal Oxide		2	913490
R26	4.7 k	Metal Oxide		2	913490
R27	4.7 k	Metal Oxide		2	913490
R28	220 k	Metal Oxide		2	921771
R29	220 k	Metal Oxide		2	921771
R30	220 k	Metal Oxide		2	921771
R31	220 k	Metal Oxide		2	921771
R32	220 k	Metal Oxide		2	921771
R33	220 k	Metal Oxide		2	921771
R34	220 k	Metal Oxide		2	921771
R35	220 k	Metal Oxide		2	921771
R36	220 k	Metal Oxide		2	921771
R37	220 k	Metal Oxide		2	921771
R38	220 k	Metal Oxide		2	921771

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capacitors					
	µF		V		
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	0.01	Ceramic Disc	250	+80 -20	900067
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067
Transistors					
TR1		BC 107			911929
TR2		BC 107			911929
TR3		BC 107			911929
Thyristors					
SCR1		2N 5064			928359
SCR2		2N 5064			928359
SCR3		2N 5064			928359
SCR4		2N 5064			928359
SCR5		2N 5064			928359
SCR6		2N 5064			928359
SCR7		2N 5064			928359
SCR8		2N 5064			928359
SCR9		2N 5064			928359
SCR10		2N 5064			928359
SCR11		2N 5064			928359

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
<u>Integrated Circuits</u>					
ML1		Quad 3 State NOR R/S Latch (CD 4043BE)			930855
ML2		Quad 2 Input AND Gate (CD 4081BE)			929322
ML3		14 Bit Ripple Counter (CD 4020BE)			930242
ML4		2 Input OR Gate (CD 4071BE)			930038
ML5		Triple 3 Input AND Gate (CD 4073BE)			929320
ML6		Quad 2 Input AND Gate (CD 4081BE)			929322
ML7		Quad Exclusive OR Gate (CD 4070BE)			930856
ML8		Quad 2 Input AND Gate (CD 4081BE)			929322
ML9		Dual 4 Input AND Gate (CD 4082BE)			930853
ML10		2 Input OR Gate (CD 4071BE)			930038
ML11		2 Input OR Gate (CD 4071BE)			930038
ML12		Quad 3 State NOR R/S Latch (CD 4043BE)			930855
ML13		Quad Exclusive OR Gate (CD 4070BE)			930856

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Miscellaneous					
LP1		Neon 2ML-115 V AC			938759
LP2		Neon 2ML-115 V AC			938759
LP3		Neon 2ML-115 V AC			938759
LP4		Neon 2ML-115 V AC			938759
LP5		Neon 2ML-115 V AC			938759
LP6		Neon 2ML-115 V AC			938759
LP7		Neon 2ML-115 V AC			938759
LP8		Neon 2ML-115 V AC			938759
LP9		Neon 2ML-115 V AC			938759
LP10		Neon 2ML-115 V AC			938759
LP11		Neon 2ML-115 V AC			938759
		14 Pin DIL			930605
		16 Pin DIL			930606
		Transipad T018/009			932515
		Transipad T018/011			933733
		Transipad EPX004			932177

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

SWITCH-ON SEQUENCE CARD

Resistors

	Ohms		W		
R1	51 k	Metal Oxide		2	916477
R2	12 k	Metal Oxide		2	917952
R3	4.7 k	Metal Oxide		2	913490
R4	100 k	Metal Oxide		2	915190
R5	100 k	Metal Oxide		2	915190
R6	10 k	Metal Oxide		2	914042
R7	100 k	Metal Oxide		2	915190
R8	22 k	Metal Oxide		2	913493
R9	4.7 k	Metal Oxide		2	913490
R10	100 k	Metal Oxide		2	915190
R11	4.7 k	Metal Oxide		2	913490
R12	100 k	Metal Oxide		2	915190
R13	100 k	Metal Oxide		2	915190
R14	22 k	Metal Oxide		2	913493
R15	22 k	Metal Oxide		2	913493
R16	56 k	Metal Oxide		2	913497
R17	100 k	Metal Oxide		2	915190
R18	4.7 k	Metal Oxide		2	913490
R19	180 k	Metal Oxide		2	920644
R20	10 k	Metal Oxide		2	914042
R21	5.6 k	Metal Oxide		2	918128
R22	22 k	Metal Oxide		2	913493
R23	100 k	Metal Oxide		2	915190
R24	470	Metal Oxide		2	920758
R25	100 k	Metal Oxide		2	915190
R26	680	Metal Oxide		2	910113
R27	680	Metal Oxide		2	910113
R28	22 k	Metal Oxide		2	913493
R29	22 k	Metal Oxide		2	913493
R30	82 k	Metal Oxide		2	915189
R31	1.8 M	Carbon Film		5	925086
R32	680	Metal Oxide		2	910113
R33	100 k	Metal Oxide		2	915190
R34	22 k	Metal Oxide		2	913493
R35	15 k	Metal Oxide		2	920645
R36	100 k	Metal Oxide		2	915190

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capactiors					
	µF		V		
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	0.01	Ceramic Disc	250	+80 -20	900067
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067
C6	0.1	Polycarbonate	100	10	931130
C7	0.1	Polycarbonate	100	10	931130
C8	0.1	Polycarbonate	100	10	931130
C9	0.01	Ceramic Disc	250	+80 -20	900067
C10	0.01	Ceramic Disc	250	+80 -20	900067
C11	0.01	Ceramic Disc	250	+80 -20	900067
C12	0.01	Ceramic Disc	250	+80 -20	900067
C13	0.01	Ceramic Disc	250	+80 -20	900067
C14	1	Tantalum	35	20	908462
C15	0.1	Polycarbonate	100	10	931130
C16	10	Tantalum	35	20	921256
C17	0.01	Ceramic Disc	250	+80 -20	900067
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898
D5		BZY 88-C12			914310
D6		BZY 88-C12			914310
Transistors					
TR1		BSS50			930859
TR2		BSS50			930859

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Integrated Circuits					
ML1		Quad AND/OR Select Gate (CD 4019BE)			930976
ML2		Quad 2 Input NOR Gate (CD 4001BE)			930027
ML3		Hex Inverter (CD 4069BE)			930999
ML4		2 Input OR Gate (CD 4071BE)			930038
ML5		Quad 3 State NOR R/S (CD 4043BE)			930855

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

SERVO PREAMPLIFIER CARD

Resistors

	Ohms		W		
R1	10 k	Metal Oxide		2	914042
R2	22 k	Variable			920314
R3	22 k	Metal Oxide		2	913493
R4	22 k	Metal Oxide		2	913493
R5	2.7 k	Metal Oxide		2	916548
R6	10 k	Metal Oxide		2	914042
R7	22 k	Metal Oxide		2	913493
R8	22 k	Metal Oxide		2	913493
R9	39 k	Metal Oxide		2	900993
R10	39 k	Metal Oxide		2	900993
R11	3.9 k	Metal Oxide		2	915074
R12	4.7 k	Metal Oxide		2	913490
R13	22 k	Metal Oxide		2	913493
R14	68 k	Metal Oxide		2	916478
R15	39 k	Metal Oxide		2	900993
R16	-				
R17	15 k	Metal Oxide		2	920645
R18	-				
R19	68 k	Metal Oxide		2	916478
R20	-				
R21	22 k	Metal Oxide		2	913493
R22	-				
R23	15 k	Metal Oxide		2	920645
R24	22 k	Metal Oxide		2	913493
R25	-				
R26	1.5 k	Metal Oxide		2	911166
R27	-				
R28	22 k	Metal Oxide		2	913493
R29	-				
R30	560 k	Metal Oxide		2	920831
R31	-				
R32	39 k	Metal Oxide		2	900993
R33	39 k	Metal Oxide		2	900993
R34	39 k	Metal Oxide		2	900993
R35	100 k	Metal Oxide		2	915190

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Resistors (Cont,d)					
	Ohms		W		
R36	2.2 k	Metal Oxide		2	916546
R37	220	Metal Oxide		2	910390
R38	2.2 k	Metal Oxide		2	916546
R39	56 k	Metal Oxide		2	913497
R40	2.2 k	Metal Oxide		2	916546
R41	220	Metal Oxide		2	910390
R42	2.2 k	Metal Oxide		2	916546
R43	100 k	Metal Oxide		2	915190
R44	560 k	Metal Oxide		2	920831
R45	10 k	Metal Oxide		2	914042
R46	2.2 k	Metal Oxide		2	916546
R47	6.8 k	Metal Oxide		2	910112
R48	1.5 k	Metal Oxide		2	911166
R49	2.2 k	Metal Oxide		2	916546
R50	10 k	Metal Oxide		2	914042
R51	15 k	Metal Oxide		2	920645
R52	68 k	Metal Oxide		2	916478
R53	15 k	Metal Oxide		2	920645
R54	68 k	Metal Oxide		2	916478
R55	3.9 k	Metal Oxide		2	915074
R56	4.7 k	Metal Oxide		2	913490
R57	330	Metal Oxide		2	915690
R58	330	Metal Oxide		2	915690
R59	22 k	Metal Oxide		2	913493
R60	18 k	Metal Oxide		2	900994
R61	8.2 k	Metal Oxide		2	918202
R62	22 k	Metal Oxide		2	913493
R63	22 k	Metal Oxide		2	913493
R64	10 k	Metal Oxide		2	914042
R65	6.8 k	Metal Oxide		2	910112
R66	1 M	Metal Oxide		2	918121
R67	10 k	Metal Oxide		2	914942

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Capacitors					
	μF		V		
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	0.01	Ceramic Disc	250	+80 -20	900067
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067
C6	0.01	Ceramic Disc	250	+80 -20	900067
C7	0.01	Ceramic Disc	250	+80 -20	900067
C8	0.01	Ceramic Disc	250	+80 -20	900067
C9	0.01	Ceramic Disc	250	+80 -20	900067
C10	0.01	Ceramic Disc	250	+80 -20	900067
C11	0.01	Ceramic Disc	250	+80 -20	900067
C12	0.01	Ceramic Disc	250	+80 -20	900067
C13	0.01	Ceramic Disc	250	+80 -20	900067
C14	100 n	Polycarbonate	100	10	931130
C15	100 n	Polycarbonate	100	10	931130
C16	0.01	Ceramic Disc	250	+80 -20	900067
C17	0.01	Ceramic Disc	250	+80 -20	900067
C18	0.01	Ceramic Disc	250	+80 -20	900067
C19	0.01	Ceramic Disc	250	+80 -20	900067
C20	100 n	Polycarbonate	100	10	931130
C21	100 n	Polycarbonate	100	10	931130
C22	0.01	Ceramic Disc	250	+80 -20	900067
C23	0.01	Ceramic Disc	250	+80 -20	900067
C24	0.01	Ceramic Disc	250	+80 -20	900067
C25	1	Electrolytic Tantalum	35	20	923571
C26	1	Electrolytic Tantalum	35	20	923571
C27	1	Electrolytic Tantalum	35	20	923571
C28	0.01	Ceramic Disc	250	+80 -20	900067
C29	0.01	Ceramic Disc	250	+80 -20	900067
C30	0.01	Ceramic Disc	250	+80 -20	900067
C31	0.01	Ceramic Disc	250	+80 -20	900067
C32	1	Electrolytic Tantalum	35	20	923571
C33	1	Polycarbonate	100	10	931133

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898
D5		1N 4149			914898
D6		1N 4149			914898
D7		1N 4149			914898
D8		1N 4149			914898
D9		BZY 88-C7V5			911681
D10		BZY 88-C7V5			911681
D11		1N 4149			914898
D12		1N 4149			914898
Integrated Circuits					
ML1		Differential 4 Channel Mux (CD 4052BE)			930147
ML2		Quad Operational Amp (CA 324E)			927613
ML3		Single 8 Channel Mux (CD 4051BE)			930035
ML4		Quad Operational Amp (CA 324E)			927613
ML5		Differential 4 Channel Mux (CD 4052BE)			930147
ML6		Quad Operational Amp (CA 324E)			927613
ML7		Hex Schmitt Trigger (CD 40106BE)			931051
Miscellaneous					
RLA		Relay 1000 Ohms 12 V			934774
		Relay 1000 Ohms 12 V			934774
		14 Pin Socket C83-14-02			930605
		16 Pin Socket C83-16-02			930606
		Handle 21-1888G			938756

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

SERVO CONTROL CARD

Resistors

Cct Ref	Ohms	Description	W	Tol %	Racal Part Number
R1	100 k	Metal Oxide		2	915190
R2	470 k	Metal Oxide		2	918443
R3	2.2 k	Metal Oxide		2	916546
R4	100 k	Metal Oxide		2	915190
R5	100 k	Metal Oxide		2	915190
R6	470 k	Metal Oxide		2	918443
R7	15 k	Metal Oxide		2	920645
R8	100 k	Metal Oxide		2	915190
R9	100 k	Metal Oxide		2	915190
R10	100 k	Metal Oxide		2	915190
R11	100 k	Metal Oxide		2	915190
R12	100 k	Metal Oxide		2	915190
R13	1 M	Metal Oxide		2	918121
R14	1 M	Metal Oxide		2	918121
R15	10 k	Metal Oxide		2	914042
R16	680	Metal Oxide		2	910113
R17	100 k	Metal Oxide		2	915190
R18	100 k	Metal Oxide		2	915190
R19	100 k	Metal Oxide		2	915190
R20	10 k	Metal Oxide		2	914042
R21	100 k	Metal Oxide		2	915190

Capacitors

Cct Ref	μF	Description	V	Tol %	Racal Part Number
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	0.01	Ceramic Disc	250	+80 -20	900067
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067
C6	0.1	Polycarbonate	100	10	931130
C7	100	Tantalum	20	10	913445
C8	1	Polycarbonate	100	10	931130
C9	0.01	Ceramic Disc	250	+80 -20	900067
C10	0.01	Ceramic Disc	250	+80 -20	900067
C11	10	Tantalum	35	20	921256
C12	1	Polyester	63	20	920404

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
<u>Diodes</u>					
D1		MV 5753			932973
D2		MV 5753			932973
D3		MV 5753			932973
D4		1N 4149			914898
D5		1N 4149			914898
D6		1N 4149			914898
<u>Integrated Circuits</u>					
ML1		Timer (CA 555CE)			933620
ML2		Quad 2 I/P OR Gate (CD 4001BE)			930027
ML3		Hex Schmitt Trigger (CD 40106BE)			931051
ML4		Dual Monostable/ Multivibrator (CD 4098BE)			927612
ML5		Quad I/P AND Gate (CD 4081BE)			929322
ML6					
ML7		Quad 3 State NOR R/S Latch (CD 4043BE)			930855
ML8		2 I/P OR Gate (CD 4071BE)			930038
ML9		Quad 2 I/P AND Gate (CD 4081BE)			929322
ML10		Quad Exclusive OR Gate (CD 4070BE)			930856

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Miscellaneous					
		8 Pin Socket C84-08-02			930604
		14 Pin Socket C84-14-02			930605
		16 Pin Socket C84-16-02			930606
		Handle 21-1888G			938756

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

MOTHER BOARD

Resistors

	Ohms		W		
R1	470	Metal Oxide		2	920758
R2	56 k	Metal Oxide		2	913497
R3	10 k	Metal Oxide		2	914042
R4	150 k	Metal Oxide		2	917954
R5	150 k	Metal Oxide		2	917954
R6	4.7 k	Metal Oxide		2	913490
R7	27 k	Metal Oxide		2	913494
R8	330	Metal Oxide		2	915690
R9	39 k	Metal Oxide		2	900993
R10	3.3 k	Metal Oxide		2	919111
R11	56 k	Metal Oxide		2	913497
R12	120 k	Metal Oxide		2	915373
R13	100 k	Metal Oxide		2	915190
R14	27 k	Metal Oxide		2	913494
R15	270 k	Metal Oxide		2	923598
R16	220 k	Metal Oxide		2	921771
R17	47 k	Metal Oxide		2	913496
R18	270 k	Metal Oxide		2	923598
R19	270 k	Metal Oxide		2	923598
R20	1 k	Metal Oxide		2	913489
R21	22 k	Metal Oxide		2	913493

Diodes

D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Connectors					
PL1		Plug 37 Way DC37P-OL2			927720
SK1		Socket 37 Way DC37S-OL2			930820
SK2		Edge Connector EZD40GT			938766
SK3		Edge Connector EZD40GT			938766
SK4		Edge Connector EZD40GT			938766
SK5		Edge Connector EZD40GT			938766
SK6		Edge Connector EZD40GT			938766
SK7		Edge Connector EZD40GT			938766
Miscellaneous					
		Key Polarizing K27			937291

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

CONTROL UNIT

Diodes

D1		LED Green MV 5253			937551
D2		LED Orange MV 5153			933410
D3		LED Red MV 5753			932973
D4		LED Red MV 5753			932973
D5		LED Red MV 5753			932973
D6		LED Red MV 5753			932973
D7		LED Red MV 5753			932973

Connectors

SK2	50 Ω	Socket Coax BNC			906125
SK3	50 Ω	Socket Coax BNC			906125

Miscellaneous

S5		Switch			CSW80958
LP1	12-15 V	Lamps Wedge Base 30-35 mA		0.5 W	932951
LP2	12-15 V	Lamps Wedge Base 30-35 mA		0.5 W	932951
LP3	12-15 V	Lamps Wedge Base 30-35 mA		0.5 W	932951
LP4	12-15 V	Lamps Wedge Base 30-35 mA		0.5 W	932951

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

MANUAL OVERRIDE BOARD

Diodes

D1		1N 4006			925856
D2		1N 4006			925856
D3		1N 4006			925856
D4		1N 4006			925856
D5		1N 4006			925856
D6		1N 4006			925856
D7		1N 4006			925856
D8		1N 4006			925856
D9		1N 4006			925856
D10		1N 4006			925856
D11		1N 4006			925856
D12		1N 4006			925856
D13		1N 4006			925856
D14		1N 4006			925856
D15		1N 4006			925856
D16		1N 4006			925856
D17		1N 4006			925856
D18		1N 4006			925856
D19		1N 4006			925856
D20		1N 4006			925856
D21		1N 4006			925856
D22		1N 4006			925856
D23		1N 4006			925856
D24		1N 4006			925856
D25		1N 4006			925856
D26		1N 4006			925856
D27		1N 4006			925856
D28		1N 4006			925856
D29		1N 4006			925856
D30		1N 4006			925856
D31		1N 4006			925856
D32		1N 4006			925856
D33		1N 4006			925856
D34		1N 4006			925856
D35		1N 4006			925856

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes (Cont'd)					
D36		1N 4006			925856
D37		1N 4006			925856
D38		1N 4006			925856
D39		1N 4006			925856
D40		1N 4006			925856
D41		1N 4006			925856
D42		1N 4006			925856
D43		1N 4006			925856
D44		1N 4006			925856
D45		1N 4006			925856
D46		1N 4006			925856
D47		1N 4006			925856
D48		1N 4006			925856
D49		1N 4006			925856

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

AMPLITUDE DISCRIMINATOR BOARD

Capacitors

	μF		V		
C1	470 p		50	10	938938
C2	0.01	Ceramic Disc	250	+80 -20	900067

Diodes

D1		HP 5082-2800			920062
D2		HP 5082-2800			920062

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

PHASE DISCRIMINATOR BOARD

Resistors

Cct Ref	Ohms	Description	W	Tol %	Racal Part Number
R1	560	Metal Oxide		2	909772
R2	150	Metal Oxide		2	936342
R3	150	Metal Oxide		2	936342
R4	150	Metal Oxide		2	936342
R5	560	Metal Oxide		2	909772
R6	150	Metal Oxide		2	936342
R7	150	Metal Oxide		2	936342
R8	150	Metal Oxide		2	936342
R9	560	Metal Oxide		2	909772
R10	560	Metal Oxide		2	909772

Capacitors

Cct Ref	µF	Description	V	Tol %	Racal Part Number
C1	0.01	Ceramic Disc	250	+80 -20	900067
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	12 p	Ceramic Disc		5	920511
C4	0.01	Ceramic Disc	250	+80 -20	900067
C5	0.01	Ceramic Disc	250	+80 -20	900067

Inductors

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
L1	0.22 H	Choke		20	924112
L2	0.68 H	Choke			919477

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
		INPUT MATCHING BOARD			
Resistors					
	Ohms		W		
R1	6.8 k	Metal Oxide		2	910112
R2	150	Wire Wound	2.5	5	913600
R3	33 k	Metal Oxide		2	913495
R4	100	Carbon Comp	2	5	929696
R5	220	Metal Oxide		2	910390
R6	100	Carbon Comp	2	5	929696
R7	100	Carbon Comp	2	5	929696
Capacitors					
	μF		V		
C1	0.22	Polycarbonate	400	20	921088
C2	0.01	Ceramic Disc	250	+80 -20	900067
C3	180 p	Silv Mica	350	1	920429
C4	180 p	Silv Mica	350	1	920429
C5	180 p	Silv Mica	350	1	920429
C6	150 p	Ceramic Disc	500	10	917742
C7	27 p	Silv Mica	125	+1 -1	923679
C8	82 p	Silv Mica	125	+1 -1	923672
C9	100	Electrolytic	63	+50 -10	923373
C10	0.01	Ceramic Disc	250	+80 -20	900067
C11	0.01	Ceramic Disc	250	+80 -20	900067
C12	0.1	Polycarbonate	100	10	931130
C13	0.01	Ceramic Disc	250	+80 -20	900067
C14	0.1	Polycarbonate	100	10	931130
Inductors					
L1		Coil Assembly			AT81383
L2		Coil Assembly			AT81385
L3		Coil Assembly			AT81384
L4		Coil Assembly			AT81384
L5		Coil Assembly			AT81384
L6		Coil Assembly			AT81383
L7		Coil Assembly			AT81385
L8		Choke Assembly			919471

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Transformers					
T1					AT81387
T2					AT81389
T3					AT81387
T4					AT81386
T5					AT81715
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898
D5		1N 4149			914898
Miscellaneous					
RLA		Relay PCB Mount			935917
RLB		Relay PCB Mount			935917
RLC		Relay PCB Mount			935917
SG1		Spark Gap			938760

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

POWER SUPPLY BOARD

Resistors

Cct Ref	Ohms	Description	W	Tol %	Racal Part Number
R1	12 k	Metal Oxide		2	917952
R2	10 k	Metal Oxide		2	914042
R3	1 k	Metal Oxide		2	913489
R4	10 k	Metal Oxide		2	914042
R5	1 k	Metal Oxide		2	913489
R6	10 k	Metal Oxide		2	914042
R7	33 k	Metal Oxide		2	913495
R8	10 k	Metal Oxide		2	914042
R9	1 k	Metal Oxide		2	913489
R10	10 k	Metal Oxide		2	914042
R11	1 k	Variable			920315
R12	2.2 k	Metal Oxide		2	916546
R13	8.2 k	Metal Oxide		2	918202
R14	1.5 k	Metal Oxide		2	907730
R15	1 k	Metal Oxide		2	913489
R16	4.7 k	Metal Oxide		2	913490
R17	2.2 k	Metal Oxide		2	916546
R18	220	Metal Oxide		2	910390
R19	68	Metal Oxide		2	916476
R20	12 k	Metal Oxide		2	917952
R21	470	Variable			920610
R22	820	Metal Oxide		2	917065
R23	4.7 k	Metal Oxide		2	913490
R24	27 k	Metal Oxide		2	913494
R25	4.7 k	Metal Oxide		2	913490
R26	39 k	Metal Oxide		2	900993
R27	10	Metal Oxide		2	920736
R28	4.7 k	Metal Oxide		2	913490
R29	390	Metal Oxide		2	909771
R30	2.2 k	Metal Oxide		2	916546
R31	3.3 k	Metal Oxide		2	918435
R32	68	Metal Oxide		2	916476
R33	3.9 k	Metal Oxide		2	910983
R34	220	Wire Wound	6	5	913678
R35	-				

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Resistors (Cont'd)					
	Ohms		W		
R36	-				
R37	100	Metal Oxide		2	913973
R38	220	Wire Wound	6	5	913678
R39	47	Wire Wound	6	5	913694
R40	47	Wire Wound	6	5	913694
R41	330	Wire Wound	6	5	913674
Capacitors					
	μF		V		
C1	-				
C2	680	Electrolytic	63	+50 -10	920247
C3	100 n	Ceramic Disc	30	+50 -25	928116
C4	100 p	Ceramic Disc	500	10	917417
C5	22	Electrolytic	63	+50 -10	938844
C6	100 n	Ceramic Disc	30	+50 -25	928116
C7	100	Electrolytic	10	20	938843
C8	1 n	Silver Mica	400	1	927807
C9	100 n	Ceramic Disc	30	+50 -25	928116
C10	1 n	Ceramic Disc	500	+40 -20	915243
C11	10	Tantalum	35	20	921256
C12	10 n	Ceramic Disc	30	+80 -20	909122
C13	68 n	Ceramic Disc	100	20	938842
C14	680	Electrolytic	63	+50 -10	920247
C15	68 n	Ceramic Disc	100	20	938842
C16	680	Electrolytic	63	+50 -10	920247
C17	680	Electrolytic	63	+50 -10	920247
C18	2.2	Polycarbonate	100	10	931134
Chokes					
L1		Choke Assy			AT81575
L2		Choke Assy			AT81570
L3		Choke Assy			AT81570

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number
Diodes					
D1		1N 4149			914898
D2		1N 4149			914898
D3		1N 4149			914898
D4		1N 4149			914898
D5		1N 4149			914898
D6		1N 4149			914898
D7		BZY88-C5V1			921970
D8		1N 4149			911460
D9		1N 4149			914898
D10		BZY88-C33V			920569
D11		UES 1302			937491
D12		UES 1302			937491
Transistors					
TR1		BC 107			911929
TR2		BSW 66A			936039
TR3		BFX 29			915267
TR4		BC 107			911929
TR5		BFX 29			915267
TR6		BSW 66A			936039
Thyristor					
SCR1		BT 151-500R			938845
Integrated Circuit					
ML1		Voltage Regulator (SG 1524J)			937496
Miscellaneous					
		16 Pin DIL			930606
		Transipad T018/009			932515
		Transipad T05/001			916847

Cct Ref	Value	Description	Rat	Tol %	Racal Part Number

SWITCHED MODE POWER SUPPLY

Resistors

	Ohms		W		
R35	0.5	Wire Wound	5	10	920417
R36	0.5	Wire Wound	5	10	920417

Capacitors

	μF		V		
C1	0.22	Polycarbonate	100	10	931131
C19	0.22	Polycarbonate	100	10	931131

Diode

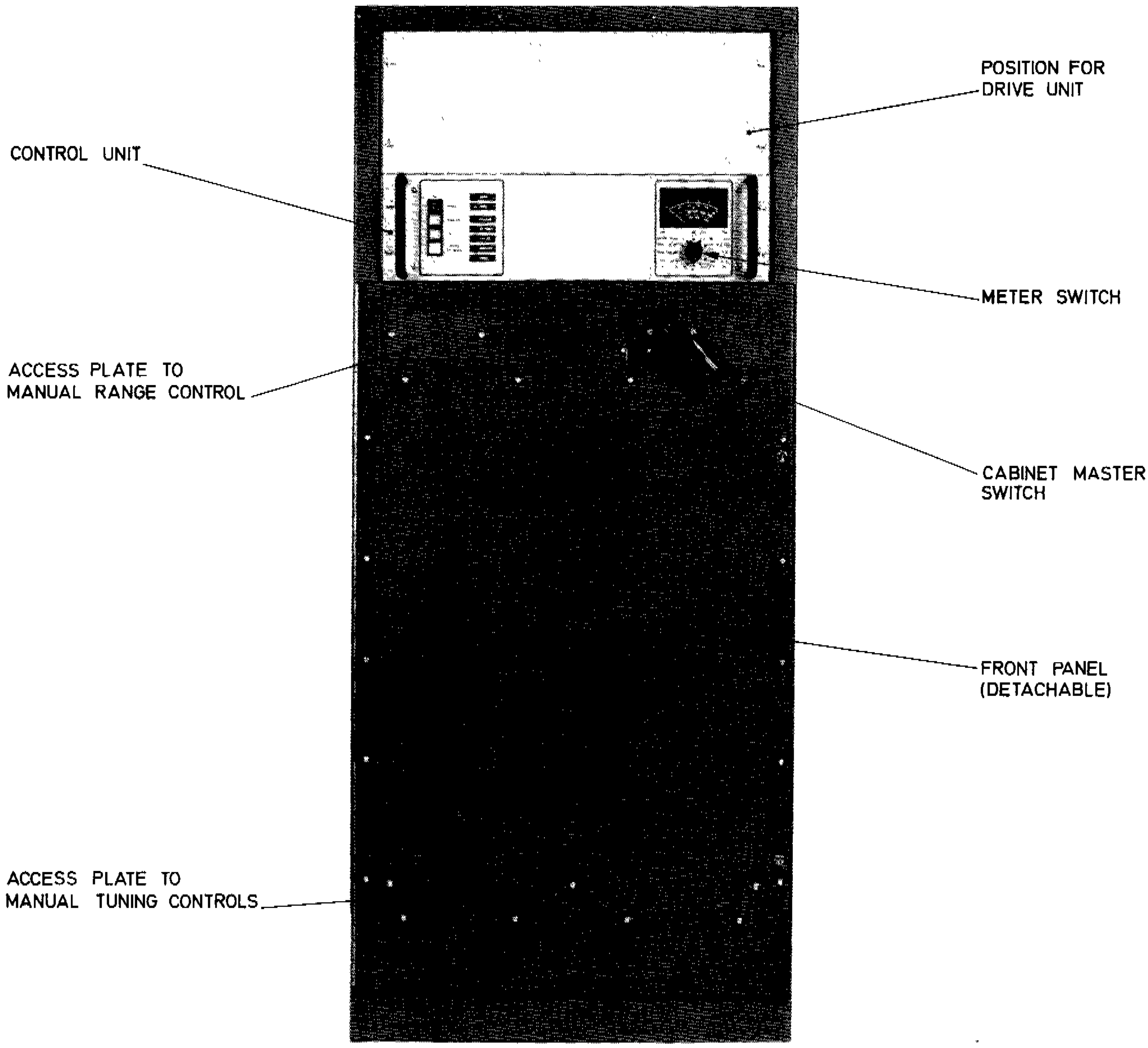
D13		BYW29-100			937939

Transistors

TR7		D45H8			937489
TR8		D45H8			937489

Miscellaneous

FS1		Fuse 10 A SF1 x 10			938819



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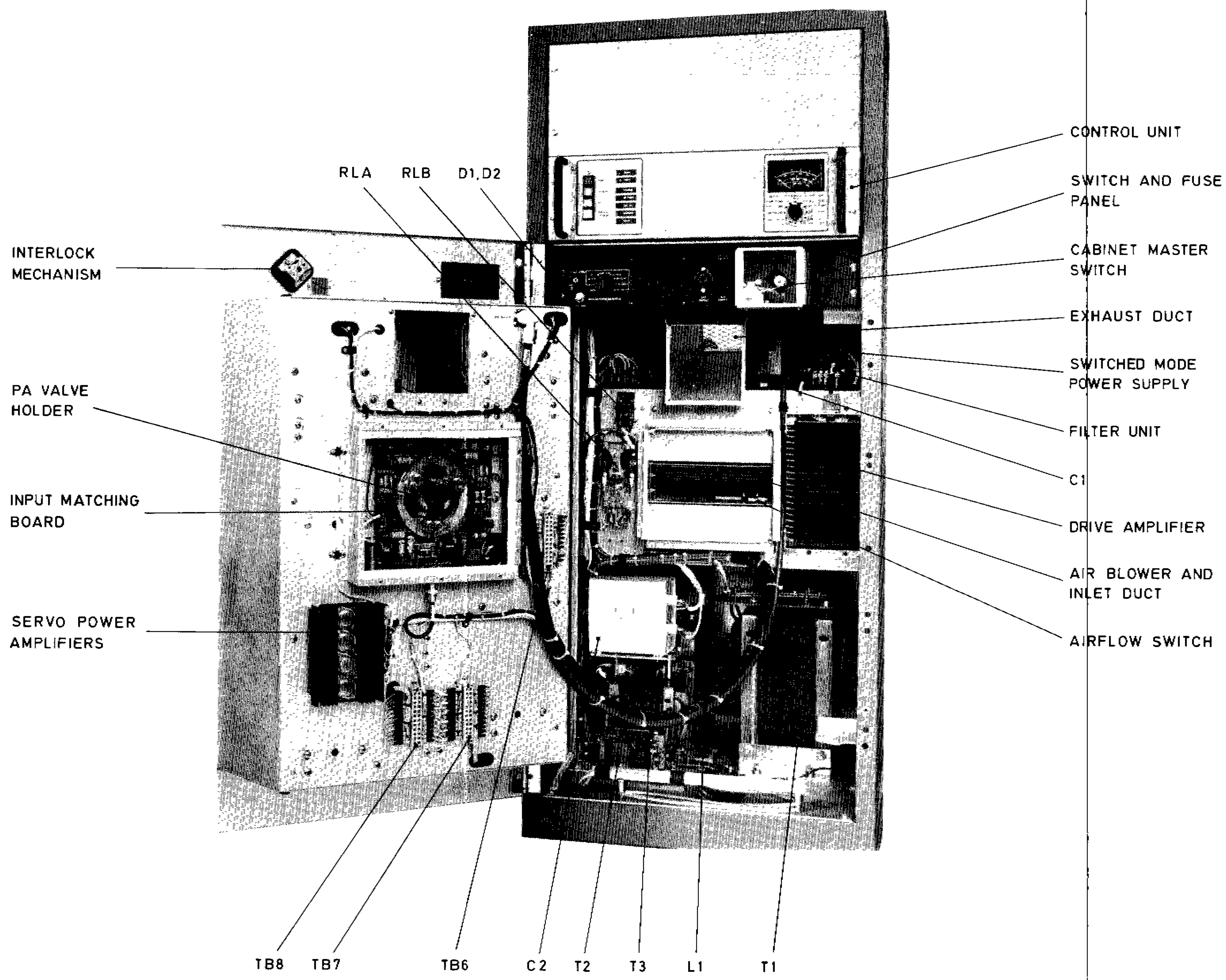
TA1823: Front View

Fig. 1



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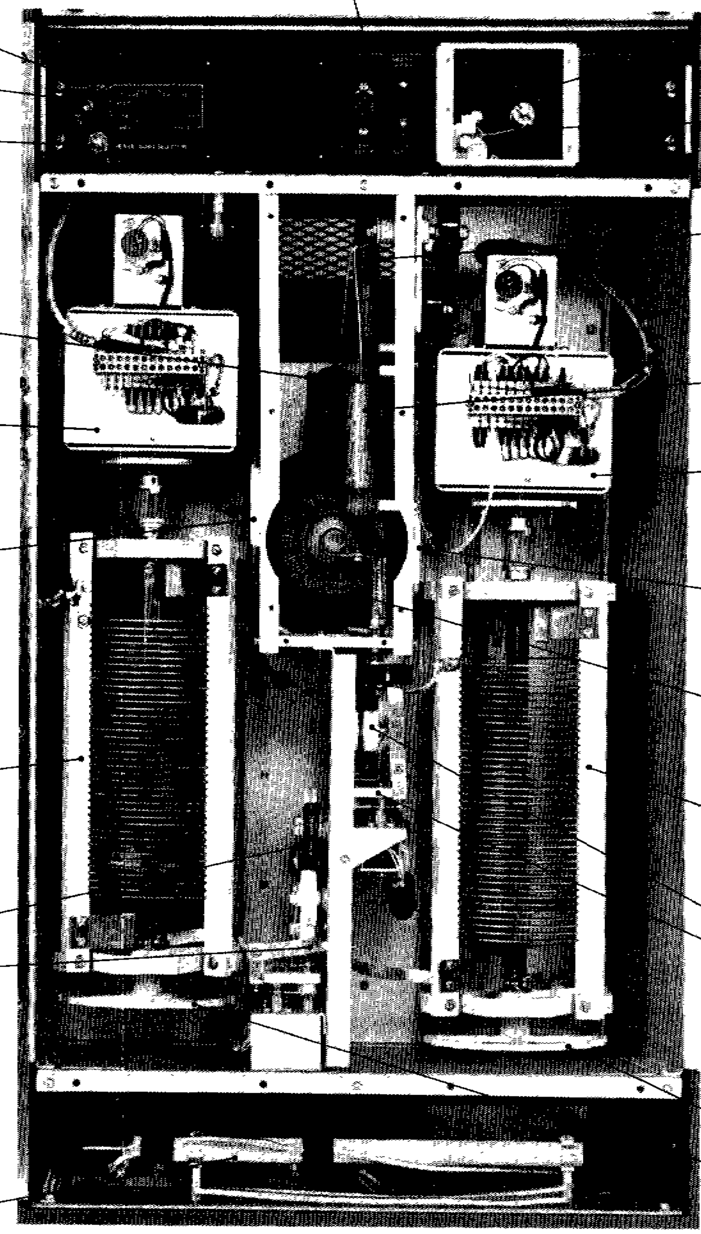
TA 1823: Front View, Door Open Fig.



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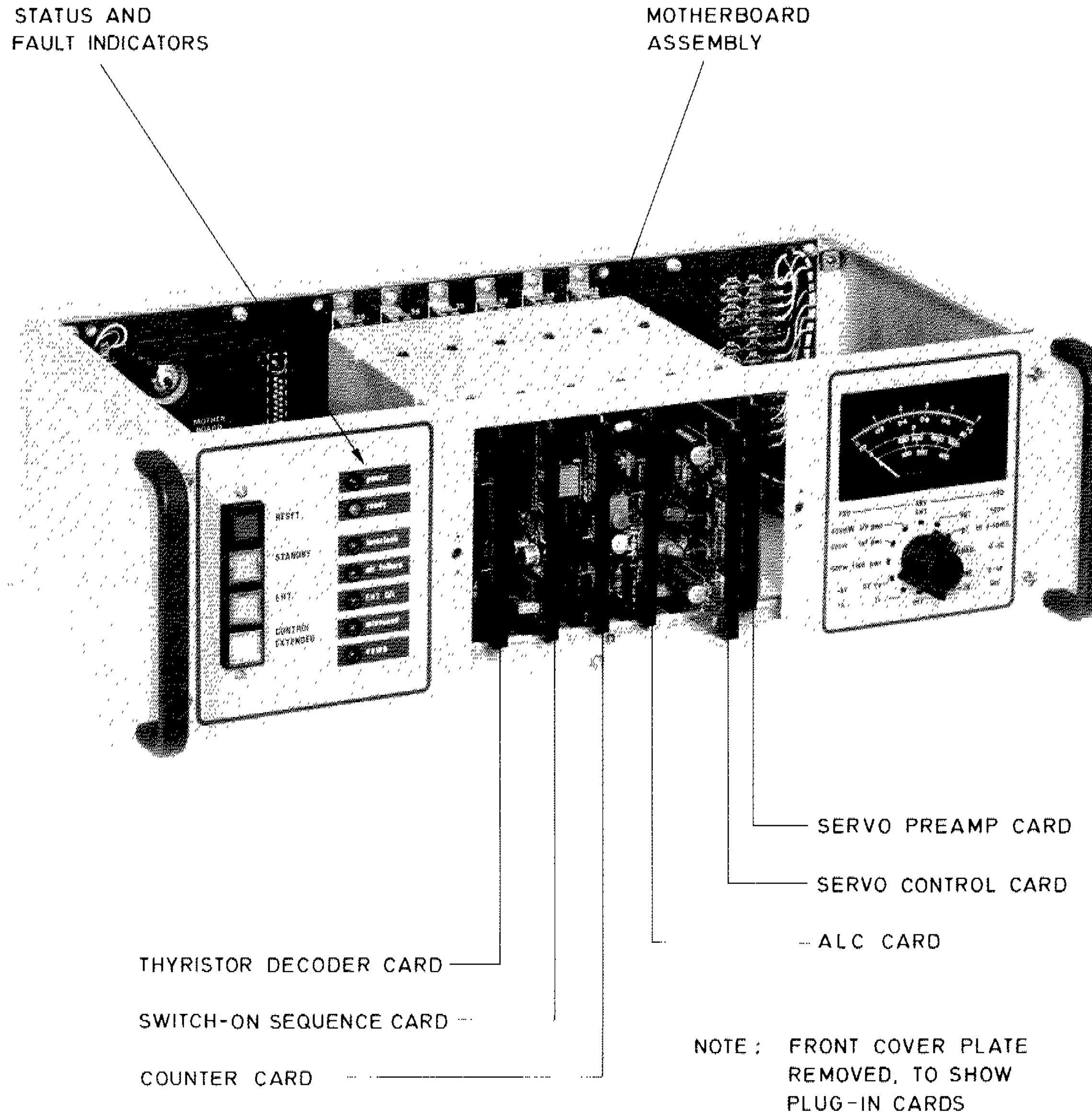
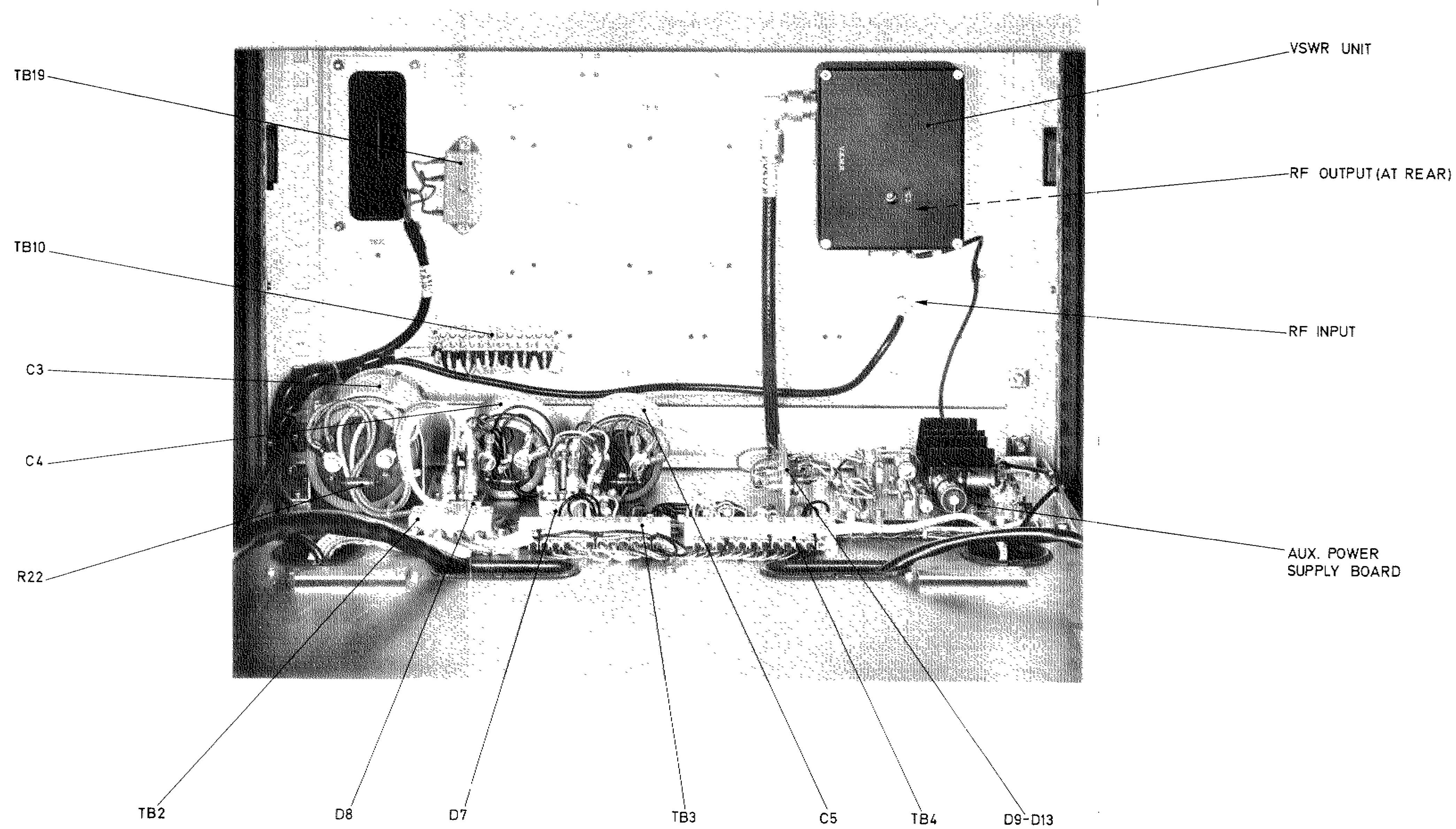
RF Compartment, with Front Panel Removed Fig

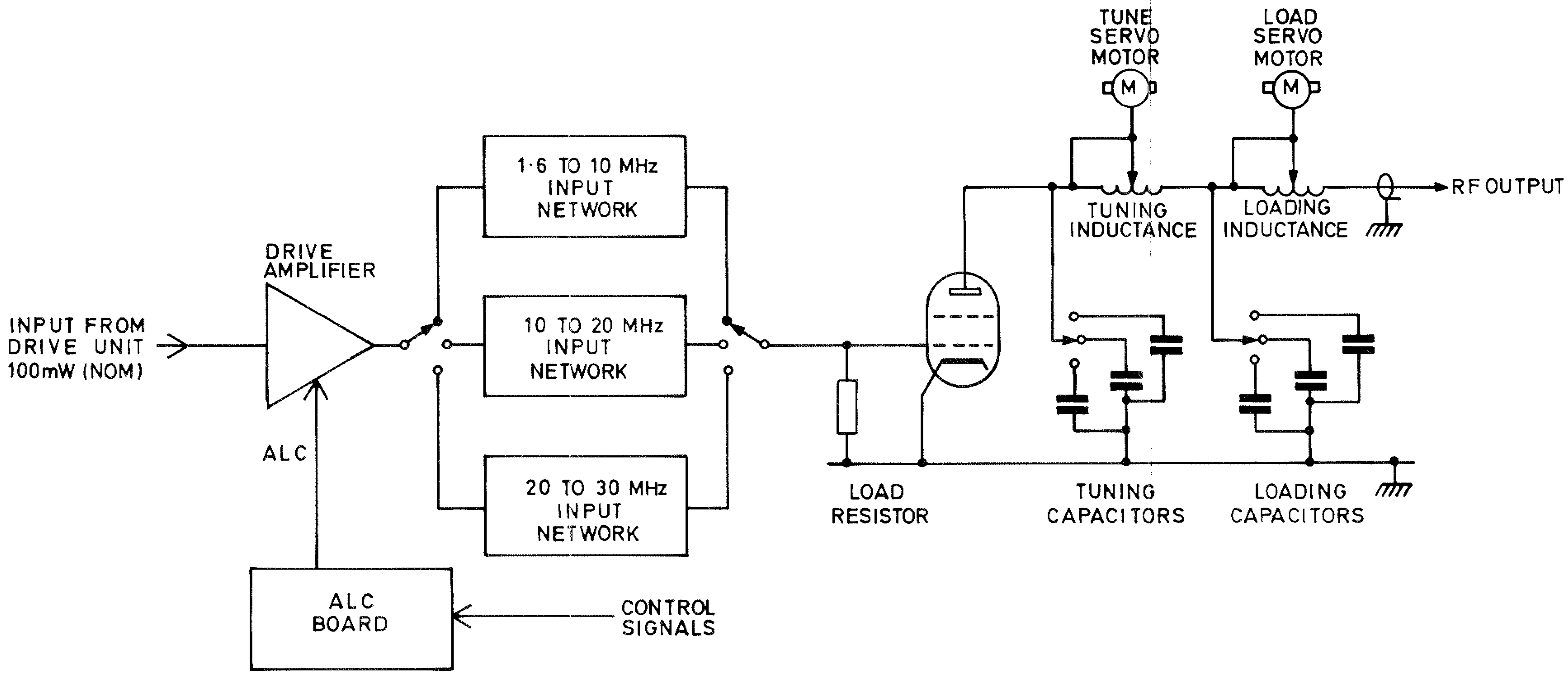


Control Unit: General View

Fig. 4



Power Supply Tray and VSWR Unit Fig.



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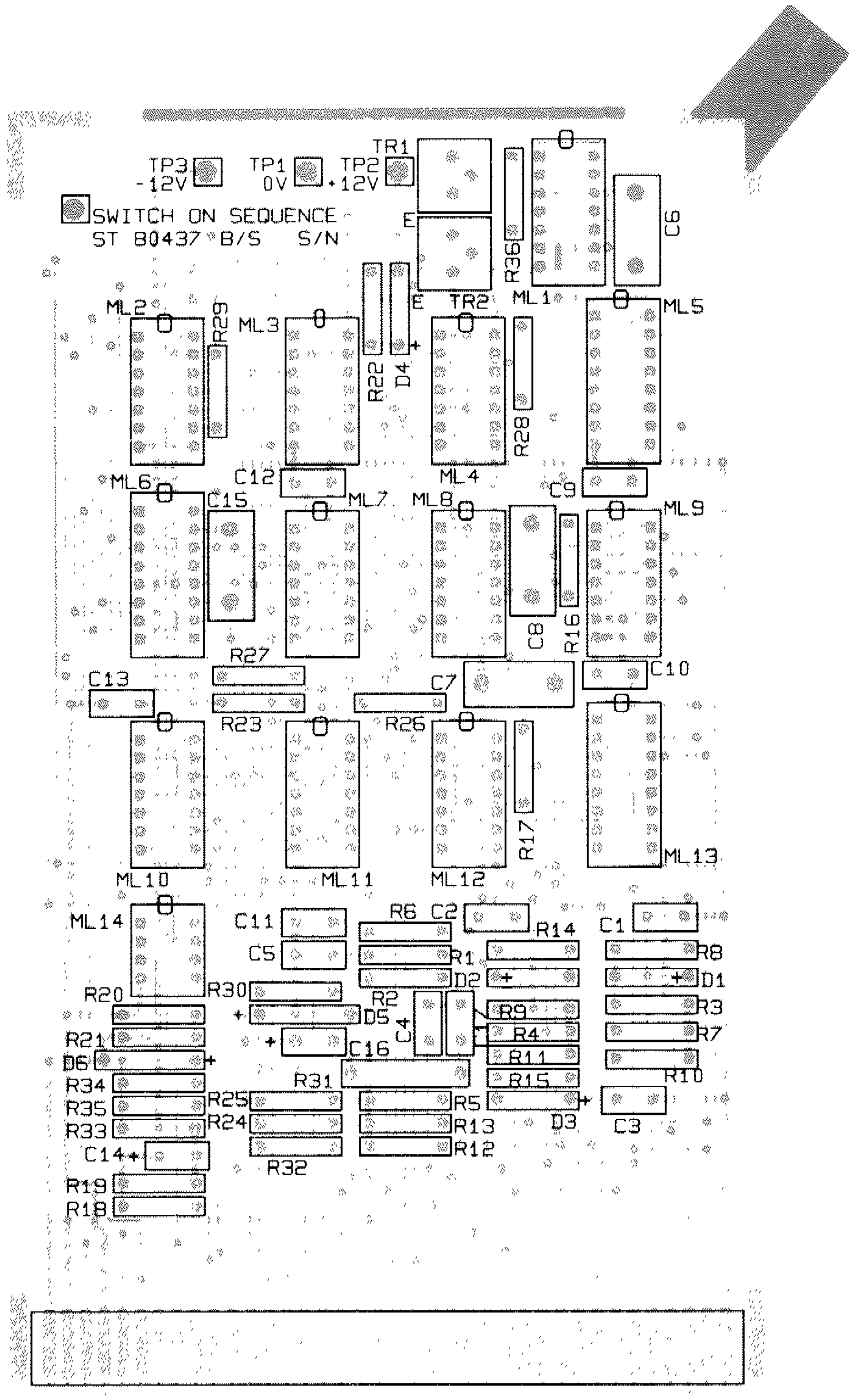
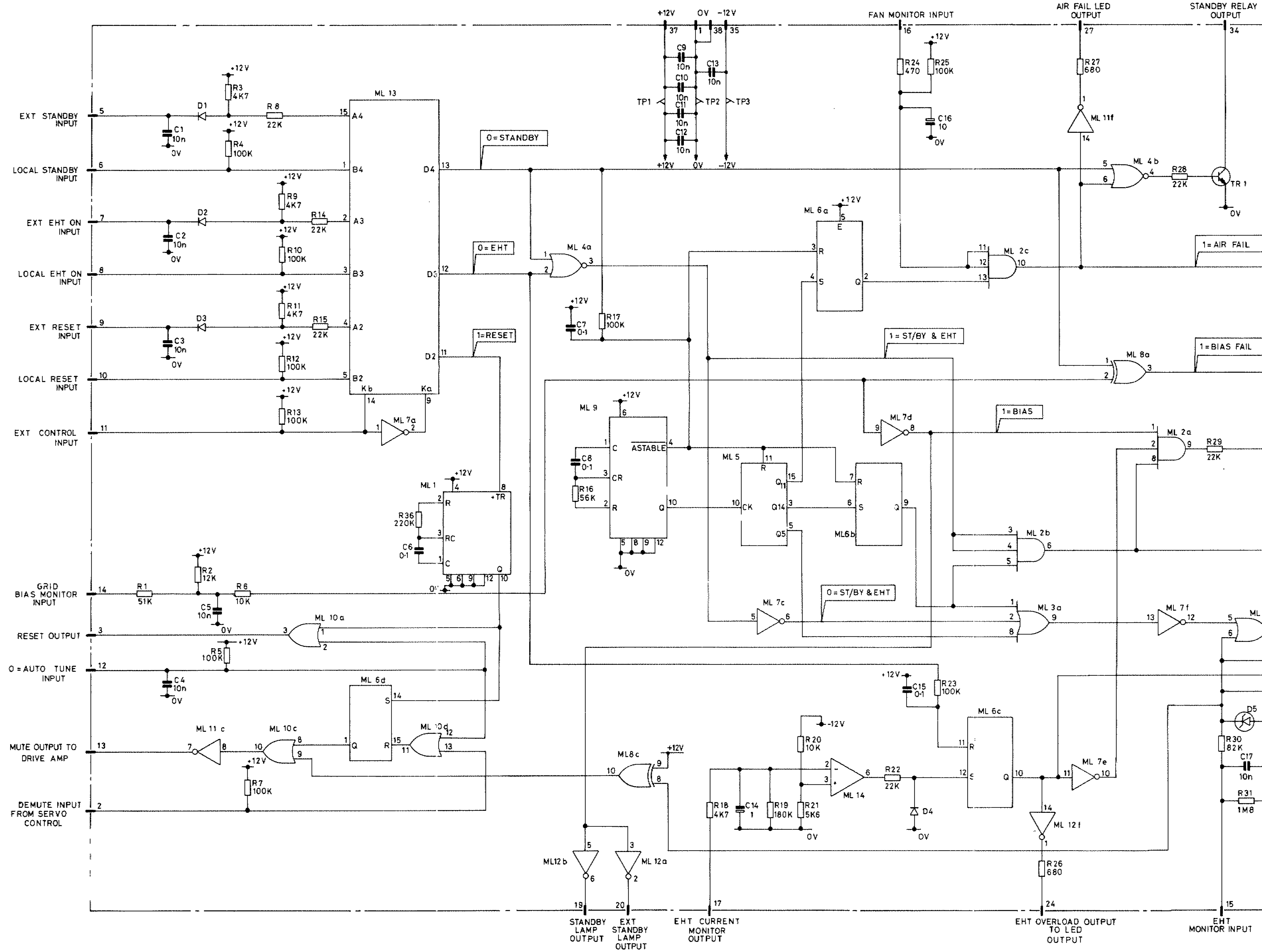
Functional Diagram:
RF Power Amplifier

F



Layout: Switch-on Sequence Card

Fig. 7



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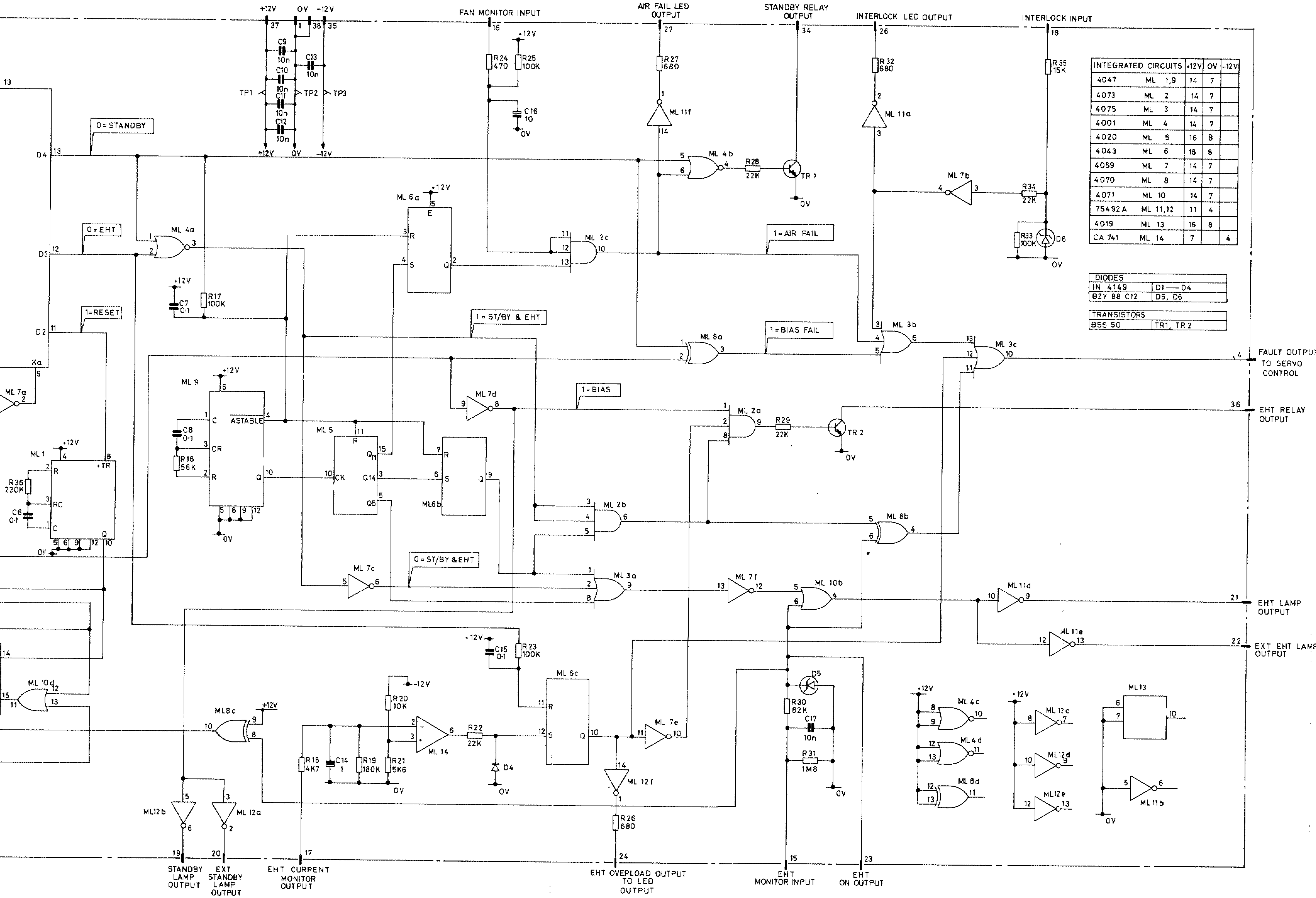
TH 2354

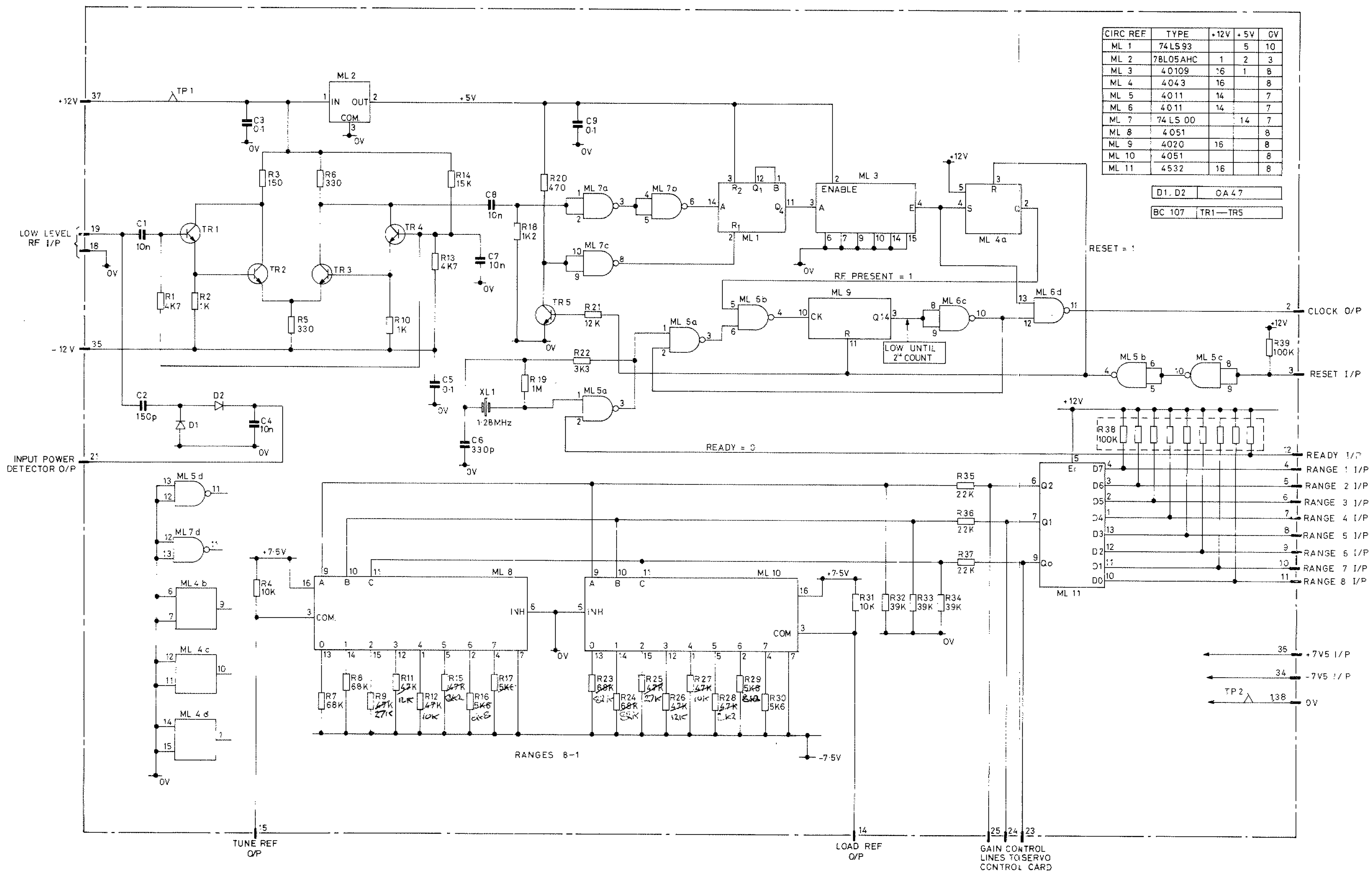


INTEGRATED CIRCUITS		+12V	0V	-12V
4047	ML 1,9	14	7	
4073	ML 2	14	7	
4075	ML 3	14	7	
4001	ML 4	14	7	
4020	ML 5	16	8	
4043	ML 6	16	8	
4069	ML 7	14	7	
4070	ML 8	14	7	
4071	ML 10	14	7	
75492A	ML 11,12	11	4	
4019	ML 13	16	8	
CA 741	ML 14	7		4

DIODES	
IN 4149	D1 — D4
BZY 88 C12	D5, D6

TRANSISTORS	
BSS 50	TR1, TR2

Circuit: Switch-on Sequence Card Fig. 8



CIRC REF	TYPE	+12V	+5V	0V
ML 1	74LS93		5	10
ML 2	78L05AHC	1	2	3
ML 3	40109	16	1	8
ML 4	4043	16		8
ML 5	4011	14		7
ML 6	4011	14		7
ML 7	74LS00		14	7
ML 8	4051			8
ML 9	4020	16		8
ML 10	4051			8
ML 11	4532	16		8

D1, D2	OA47
BC 107	TR1—TR5

If Ua dosent peak enough, check pre set values R23-30 for loading coil position

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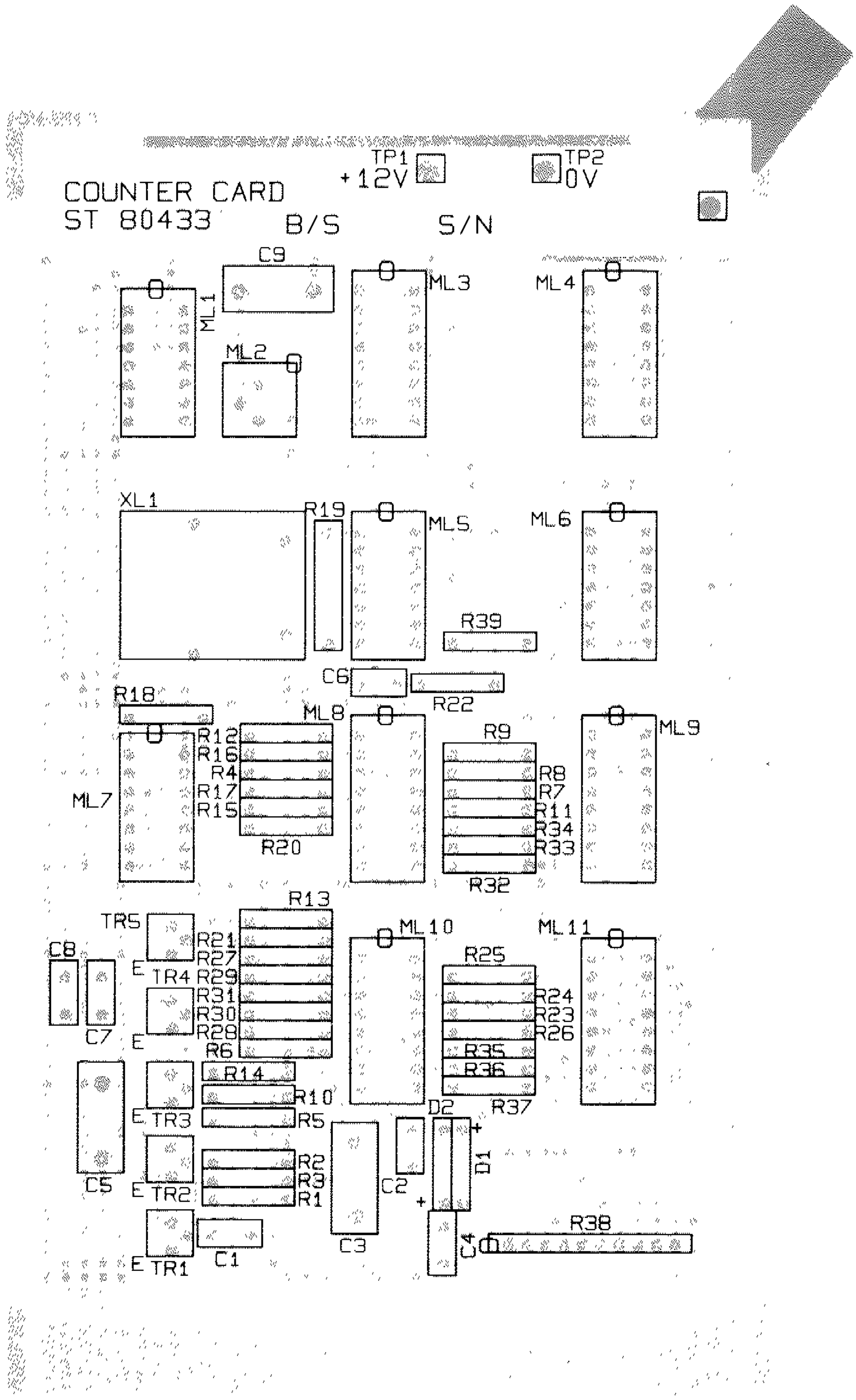
Circuit : Counter Card

Fig



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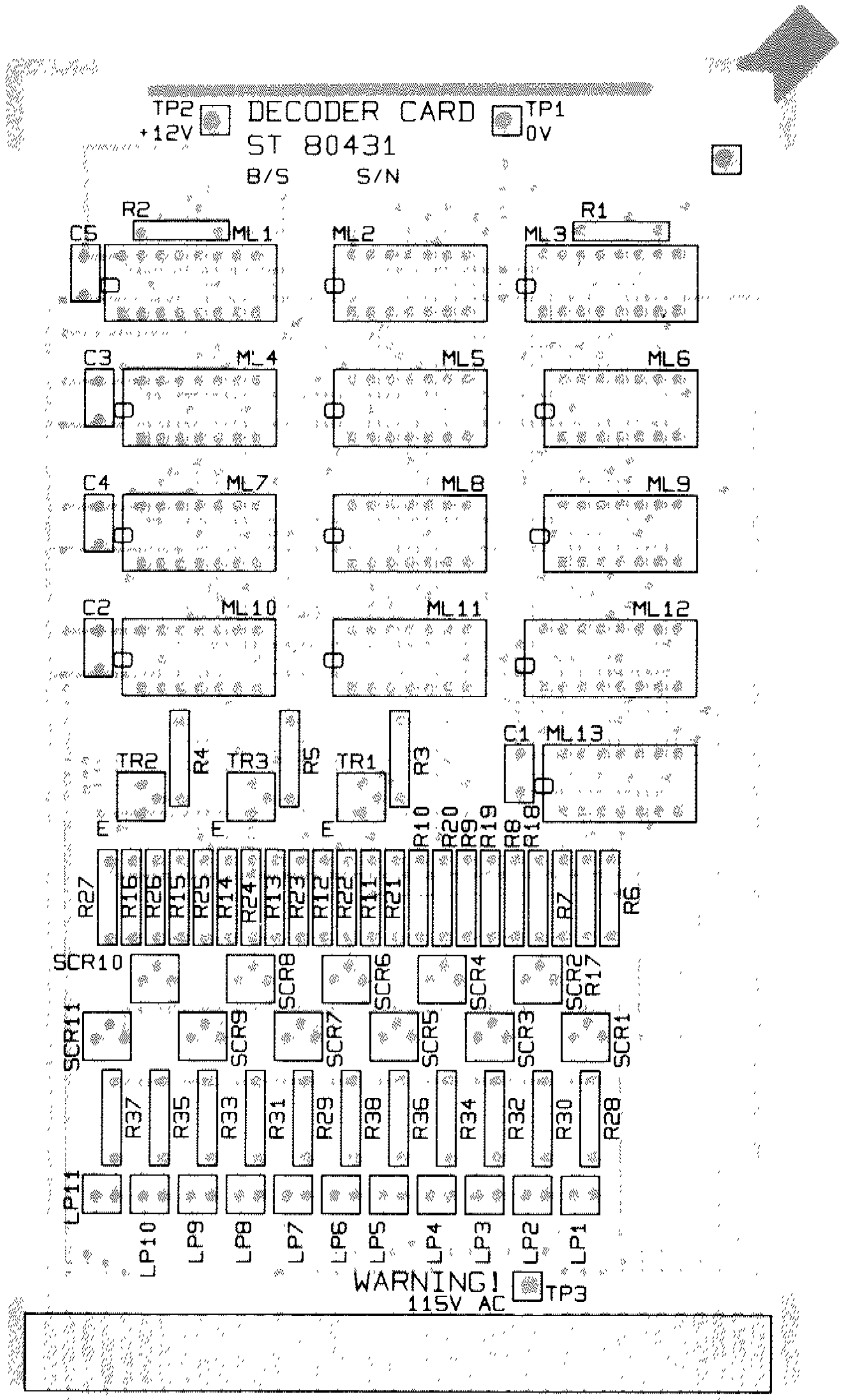
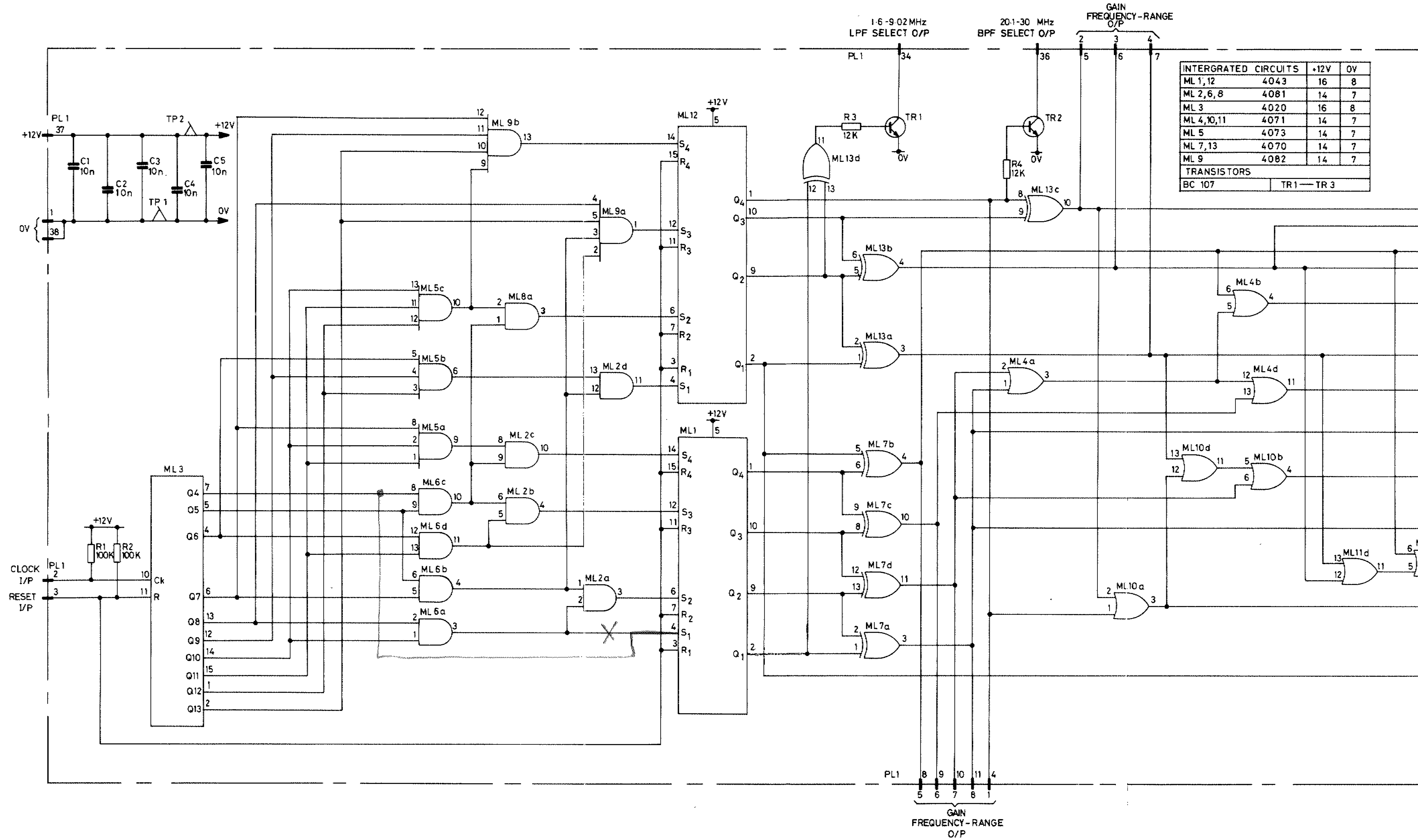
Layout : Counter Card

Fig. 9



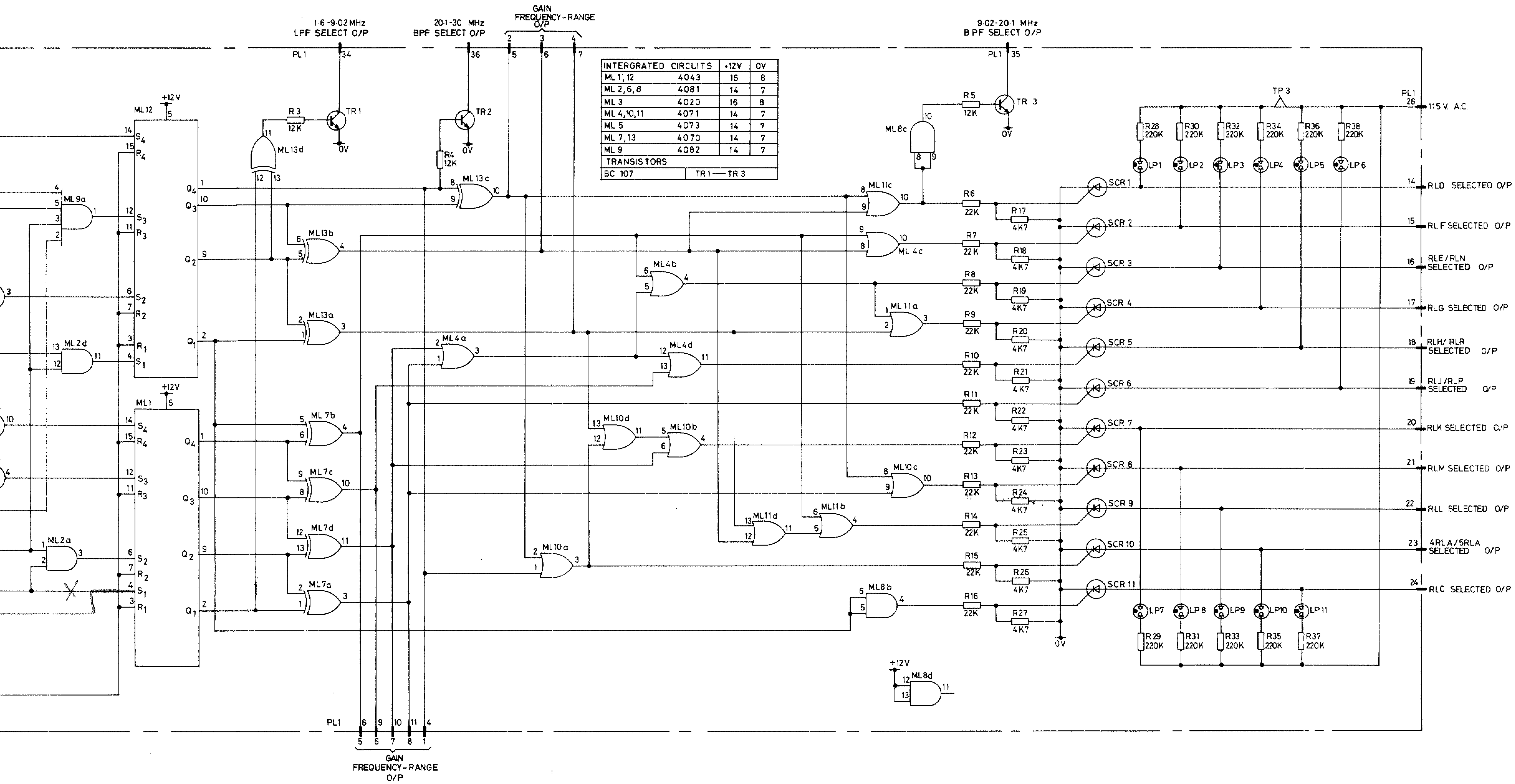
Layout: Thyristor Decoder Card

Fig. 11



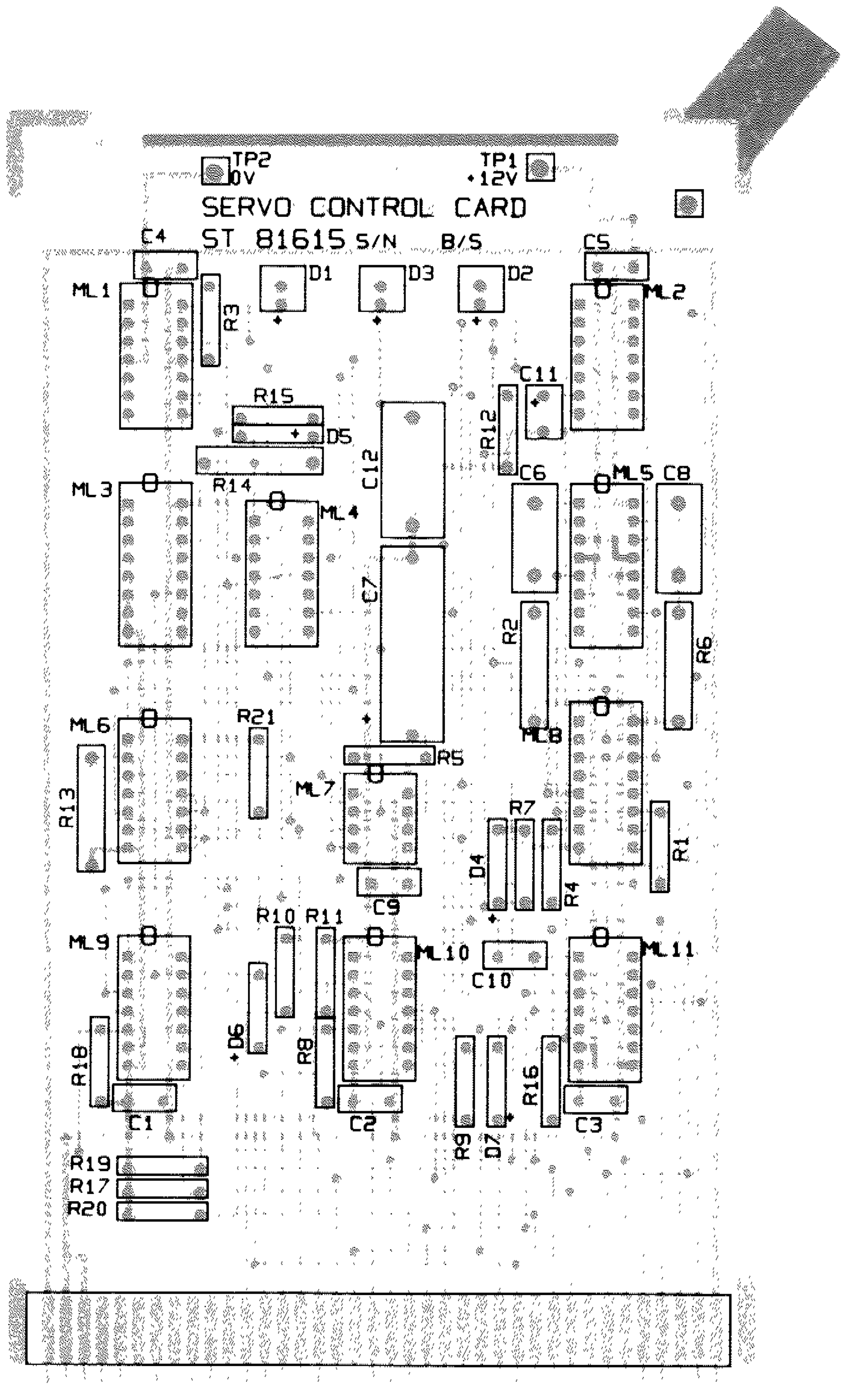
INTERGRATED CIRCUITS		+12V	0V
ML 1, 12	4043	16	8
ML 2, 6, 8	4081	14	7
ML 3	4020	16	8
ML 4, 10, 11	4071	14	7
ML 5	4073	14	7
ML 7, 13	4070	14	7
ML 9	4082	14	7
TRANSISTORS			
BC 107	TR 1 — TR 3		

TH 2354



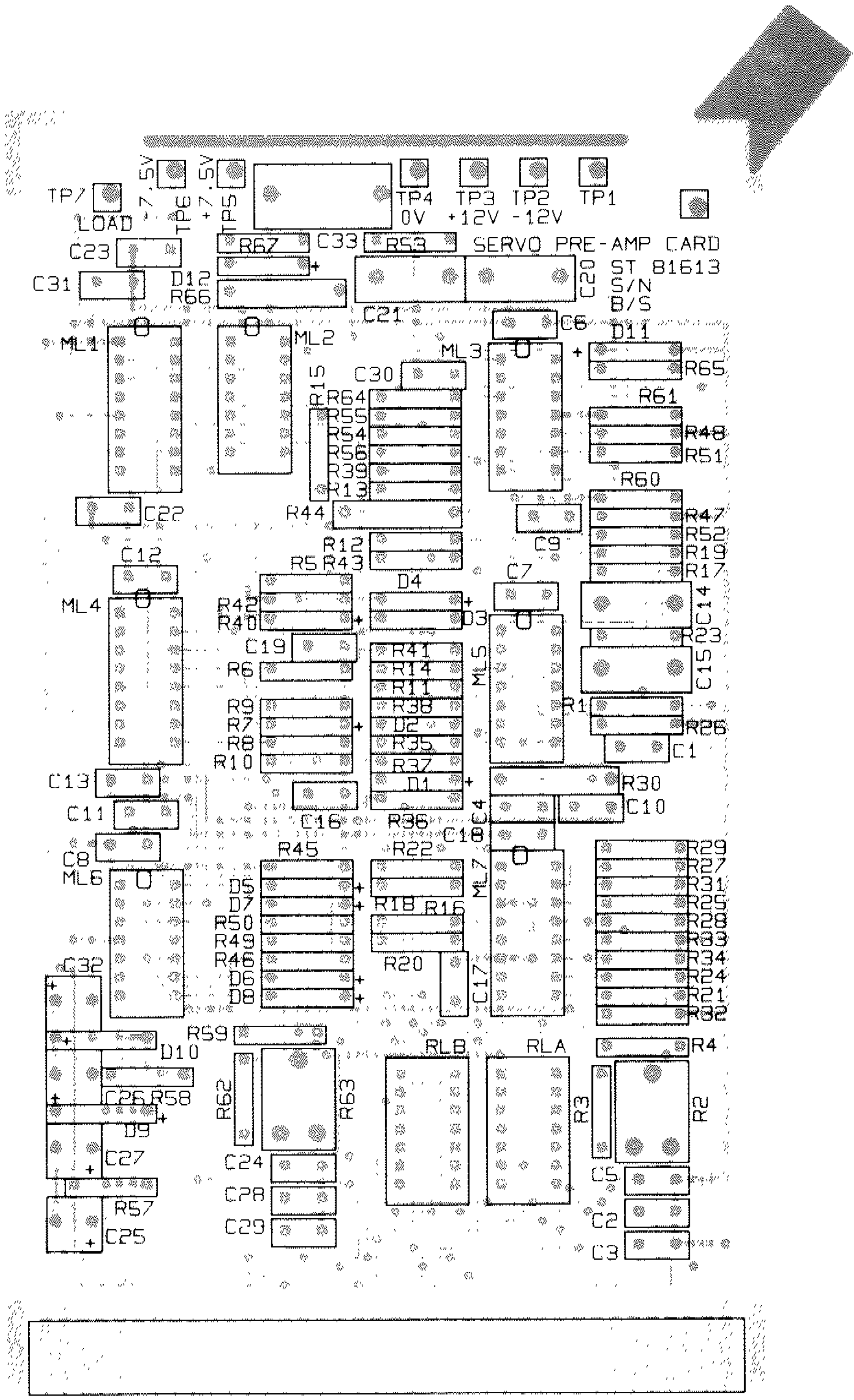
INTERGRATED CIRCUITS		+12V	0V
ML 1, 12	4043	16	8
ML 2, 6, 8	4081	14	7
ML 3	4020	16	8
ML 4, 10, 11	4071	14	7
ML 5	4073	14	7
ML 7, 13	4070	14	7
ML 9	4082	14	7
TRANSISTORS			
BC 107	TR1 — TR3		

Circuit:
Thyristor Decoder Card Fig.12



Layout: Servo Control Card

Fig. 13



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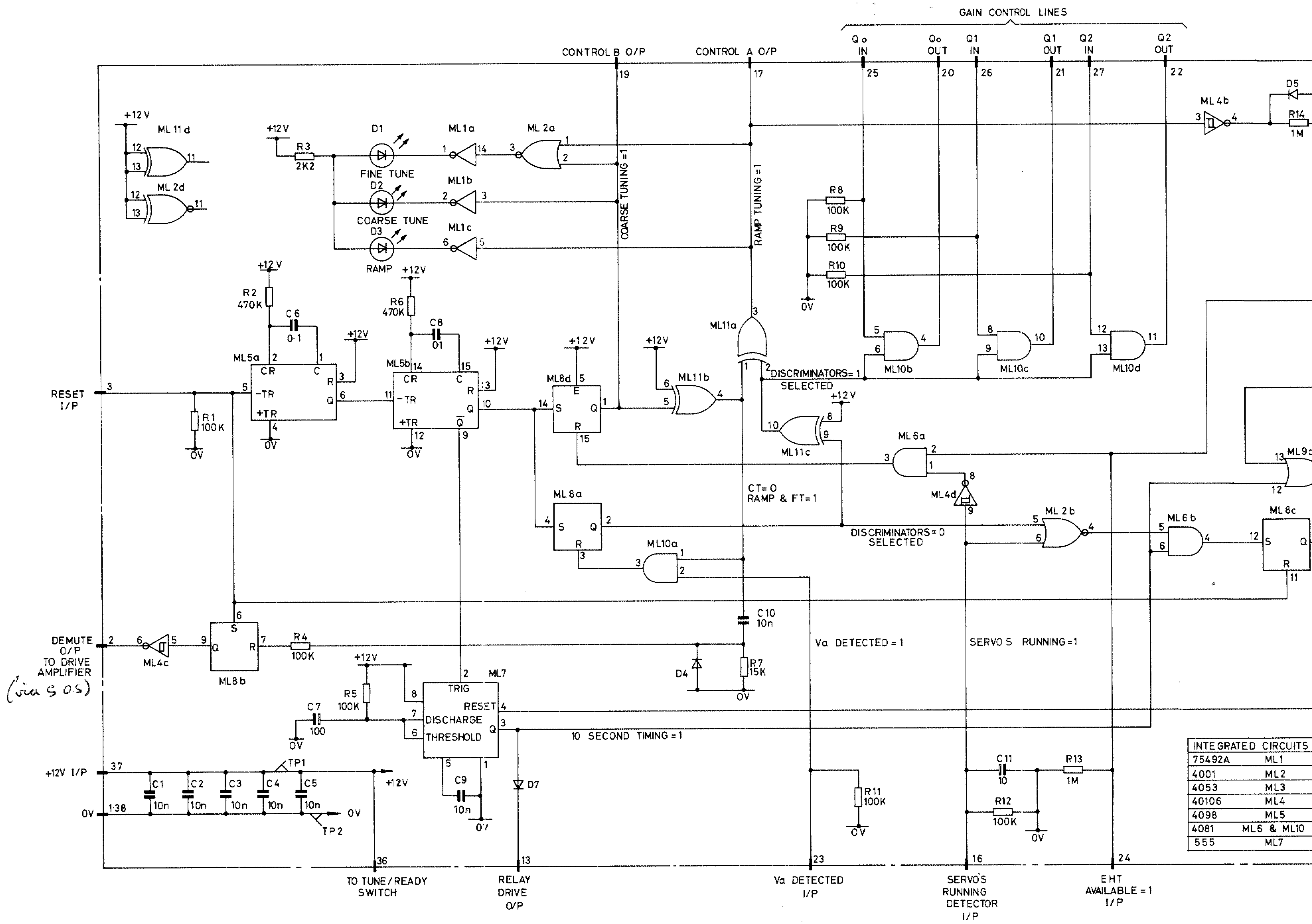
Layout : Servo Preamp Card

Fig. 15



INTEGRATED CIRCUITS	
75492A	ML1
4001	ML2
4053	ML3
40106	ML4
4098	ML5
4081	ML6 & ML10
555	ML7

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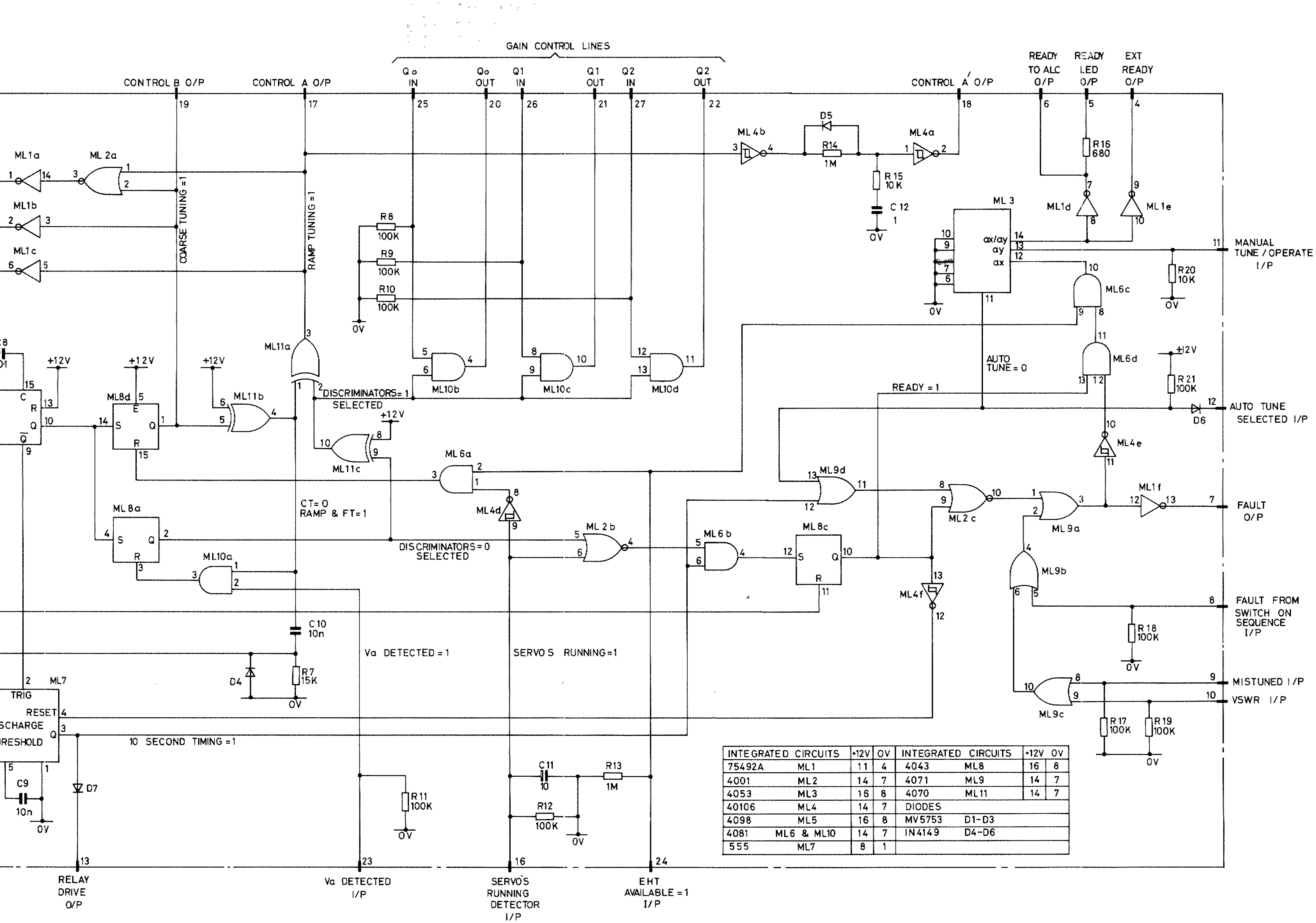
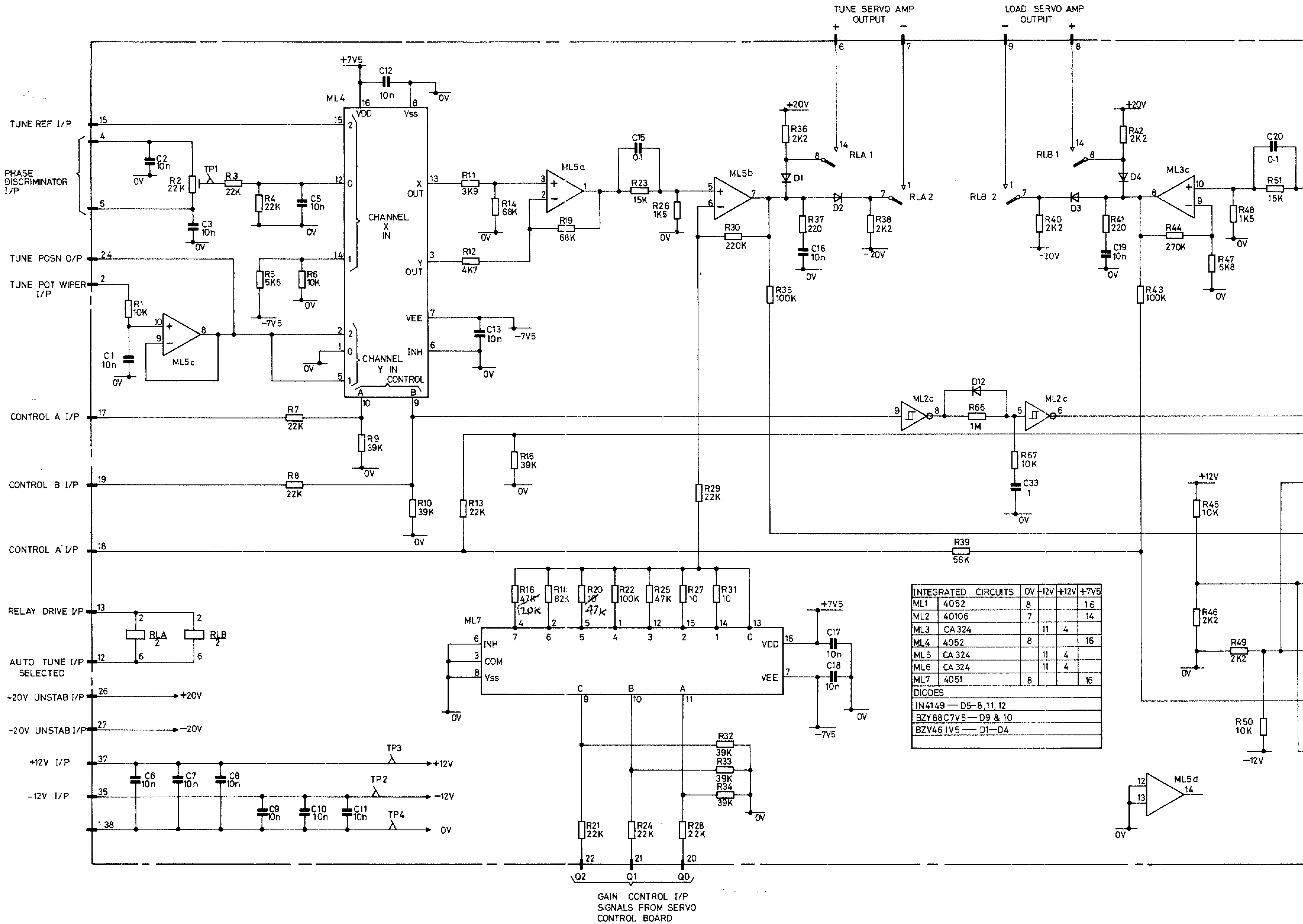
TH 2354



INTEGRATED CIRCUITS		+12V	OV	INTEGRATED CIRCUITS		+12V	OV
75492A	ML1	11	4	4043	ML8	16	8
4001	ML2	14	7	4071	ML9	14	7
4053	ML3	16	8	4070	ML11	14	7
40106	ML4	14	7	DIODES			
4098	ML5	16	8	MV5753	D1-D3		
4081	ML6 & ML10	14	7	IN4149	D4-D6		
555	ML7	8	1				

Circuit:
Servo Control Card Fig. 14



INTEGRATED CIRCUITS		0V	-12V	+12V	+7V5
ML1	4052	8			16
ML2	40106	7			14
ML3	CA 324		11	4	
ML4	4052	8			16
ML5	CA 324		11	4	
ML6	CA 324		11	4	
ML7	4051	8			16

DIODES
IN4149 — D5–8, 11, 12
BZY88C7V5 — D9 & 10
BZV46 1V5 — D1–D4

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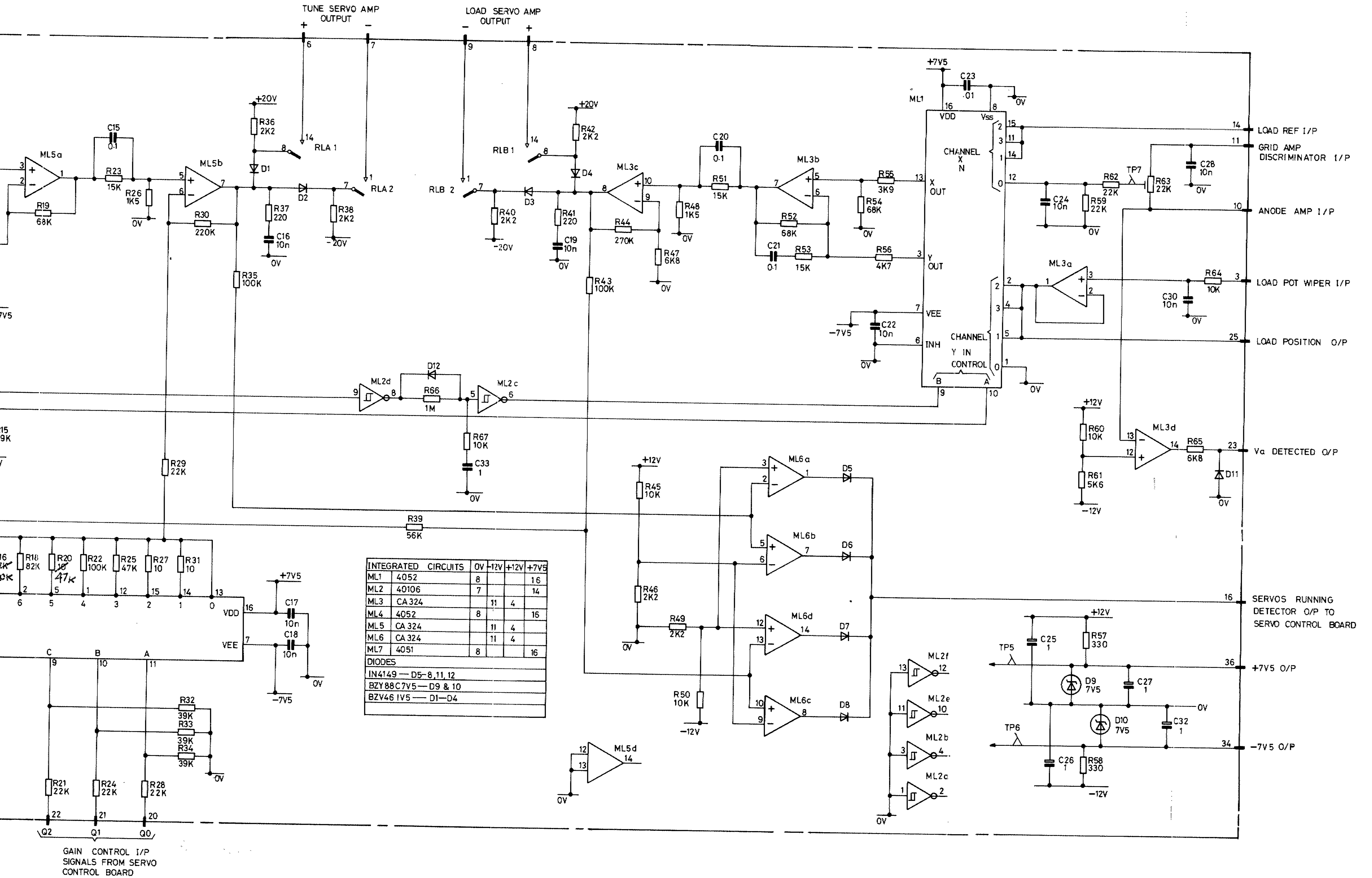
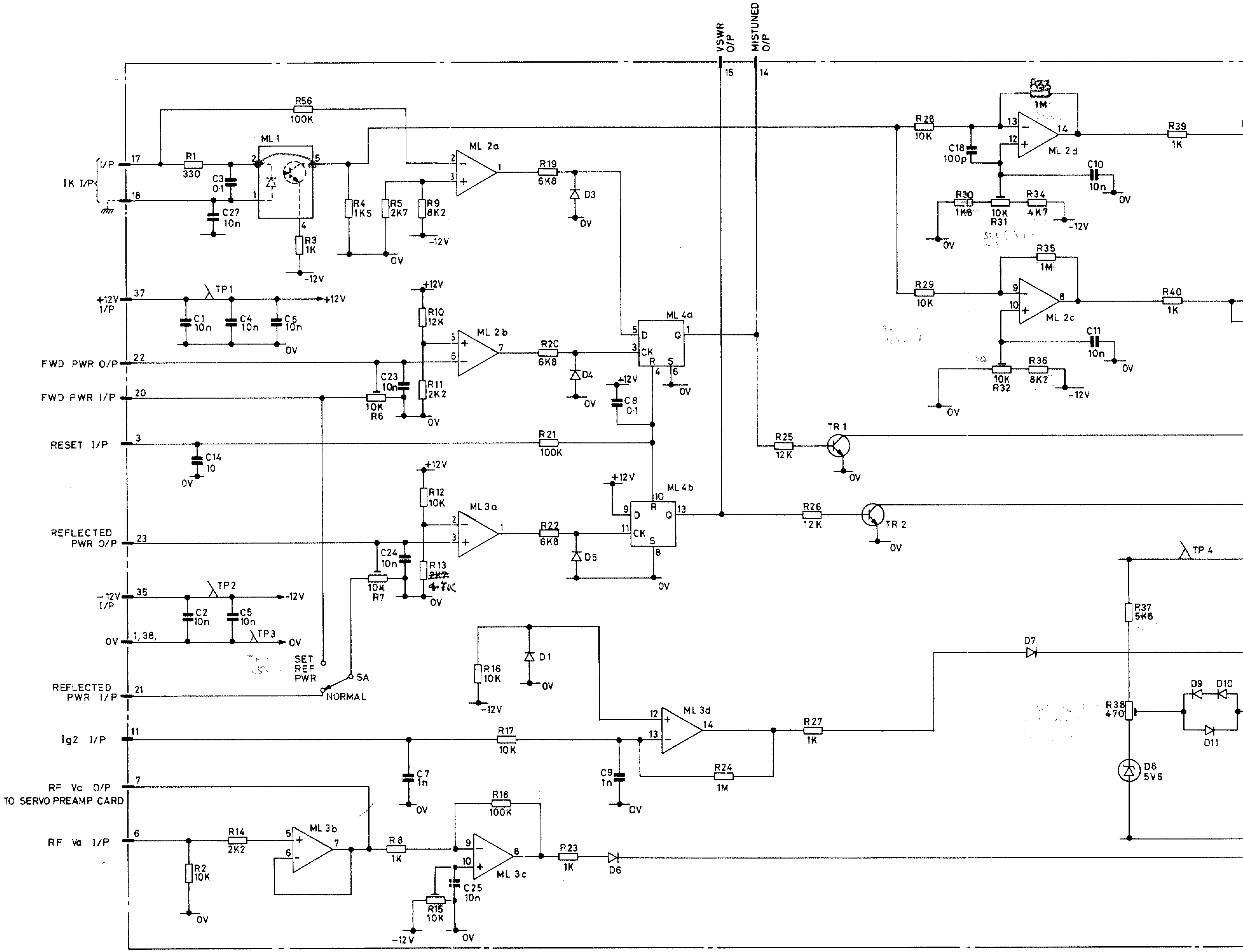
TH 2354



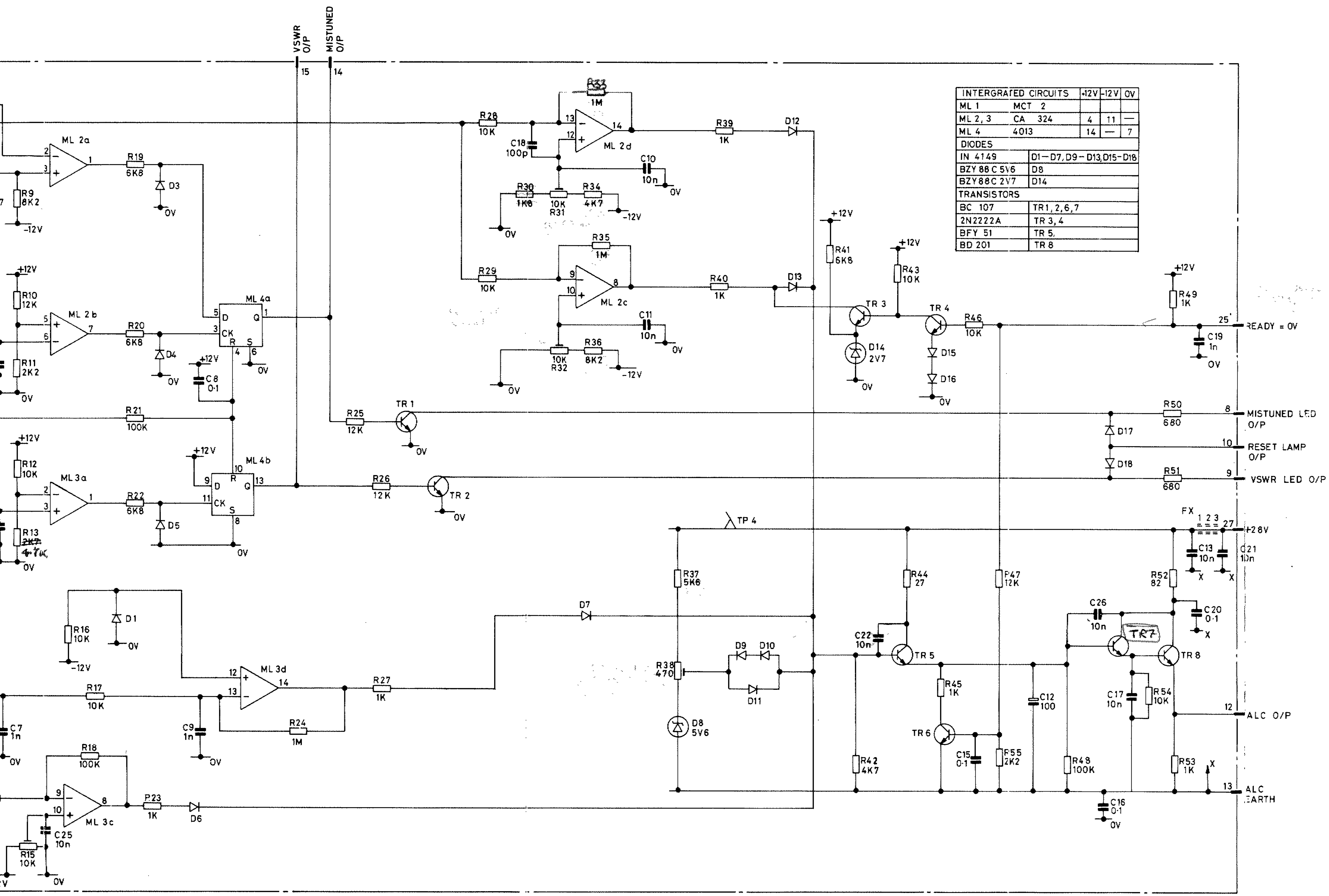
INTEGRATED CIRCUITS		0V	-12V	+12V	+7V5
ML1	4052	8			16
ML2	40106	7			14
ML3	CA 324		11	4	
ML4	4052	8			16
ML5	CA 324		11	4	
ML6	CA 324		11	4	
ML7	4051	8			16
DIODES					
IN4149 — D5–8, 11, 12					
BZY88C7V5 — D9 & 10					
BZV46 IV5 — D1—D4					

Circuit:
Servo Preamp Card Fig. 16



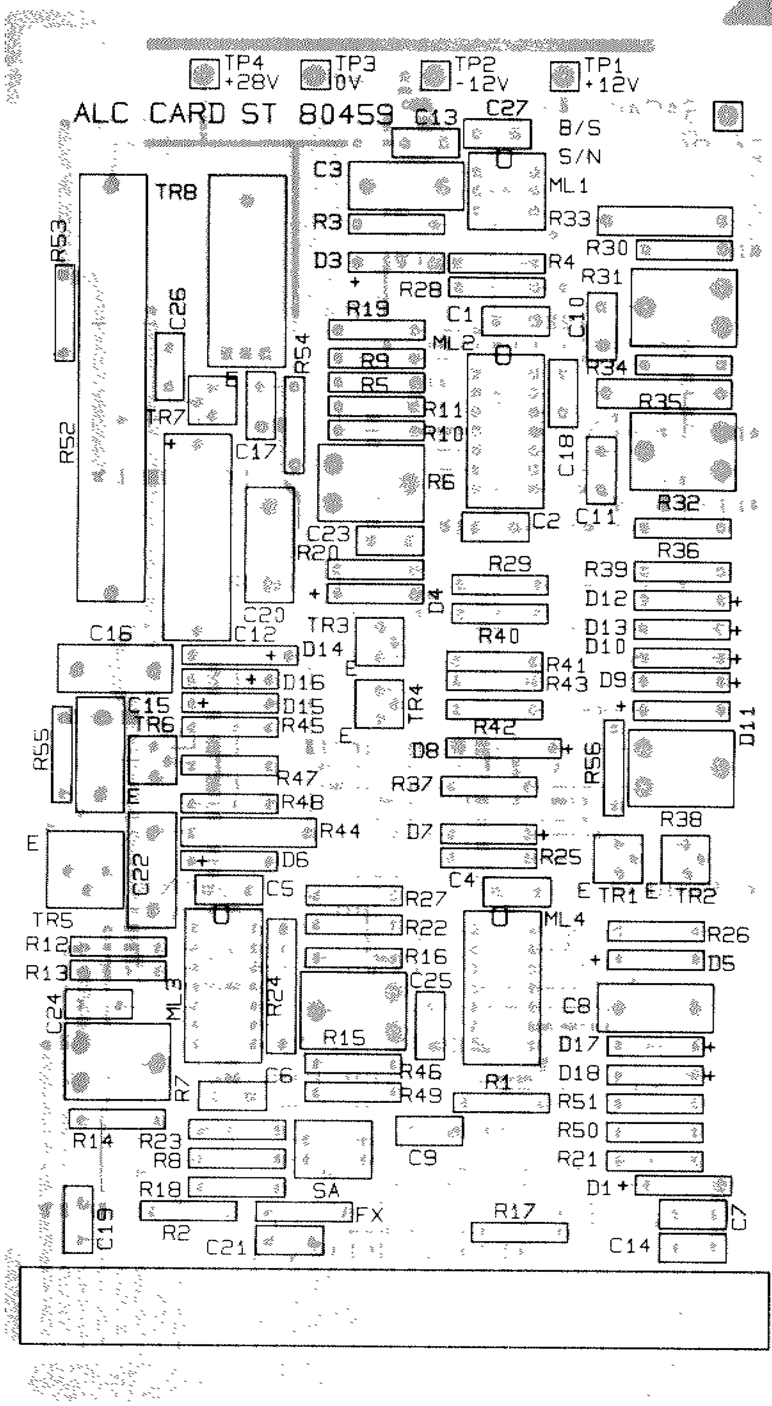
RACAL

TH 2354



INTERGRATED CIRCUITS		+12V	-12V	0V
ML 1	MCT 2			
ML 2, 3	CA 324	4	11	—
ML 4	4013	14	—	7
DIODES				
IN 4149	D1—D7, D9—D13, D15—D18			
BZY 88 C 5V6	D8			
BZY 88C 2V7	D14			
TRANSISTORS				
BC 107	TR1, 2, 6, 7			
2N2222A	TR 3, 4			
BFY 51	TR 5,			
BD 201	TR 8			

Circuit:
ALC Card Fig.18



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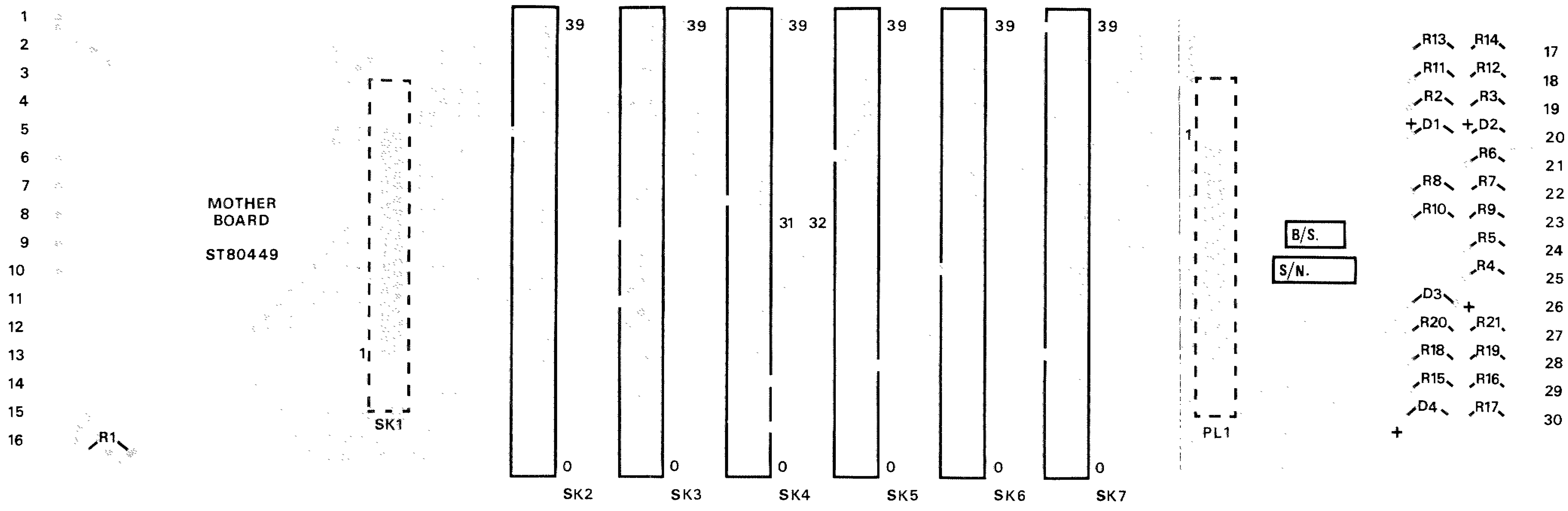
Layout : ALC Card

Fig. 17



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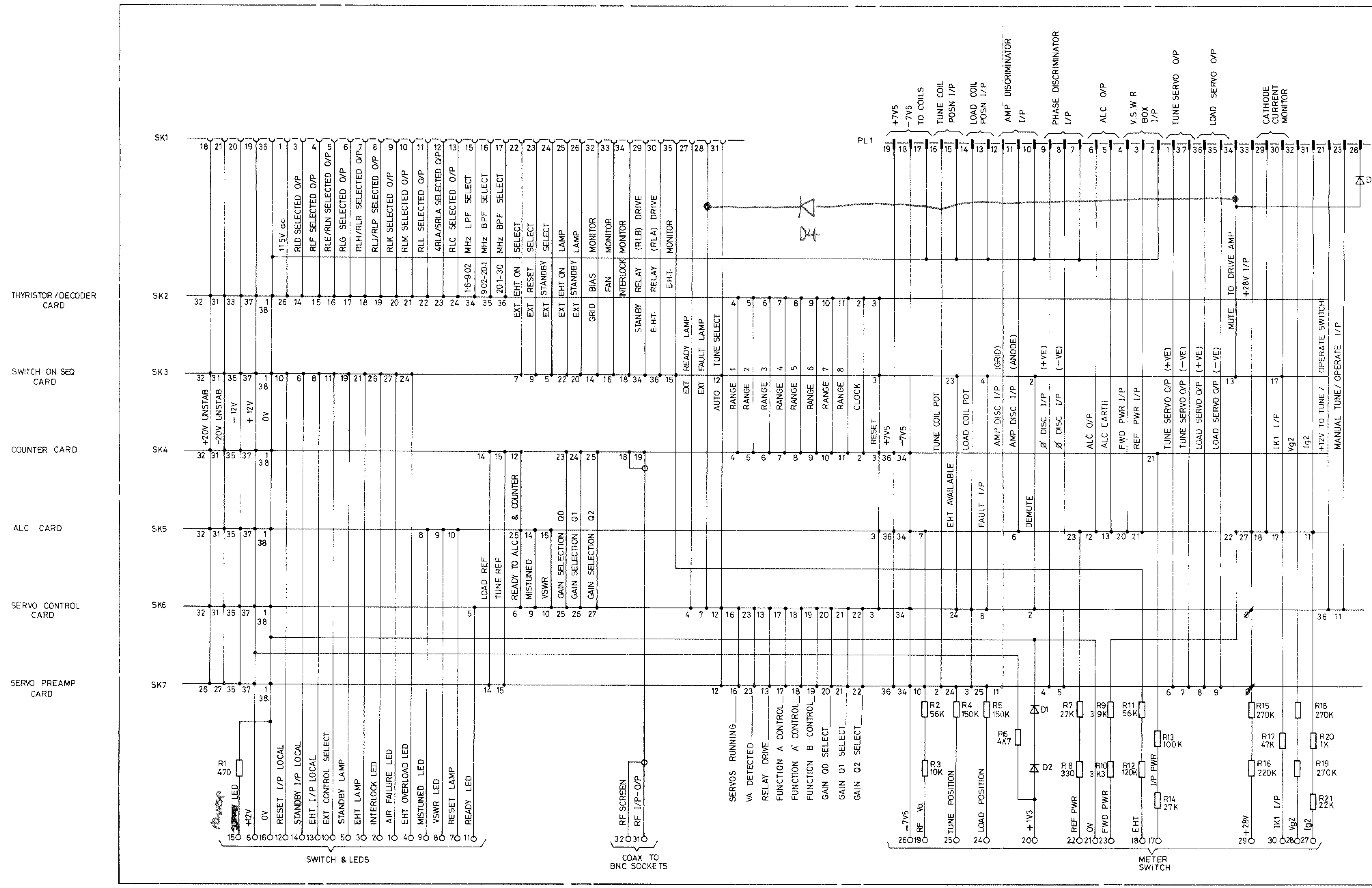
Layout :
Motherboard

Fig.



Circuit : Motherboard Fig

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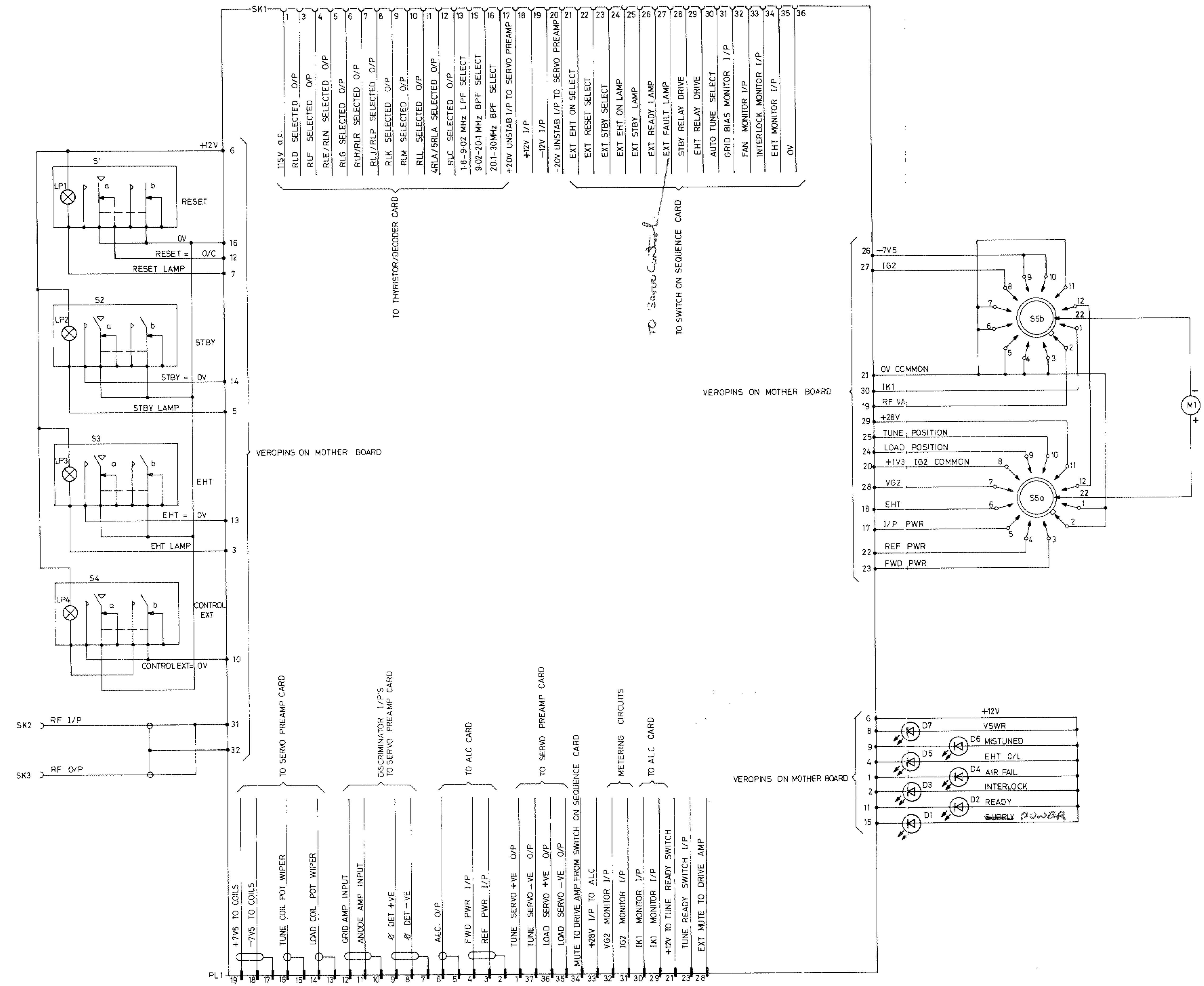

Circuit :
Control Unit Chassis Fi

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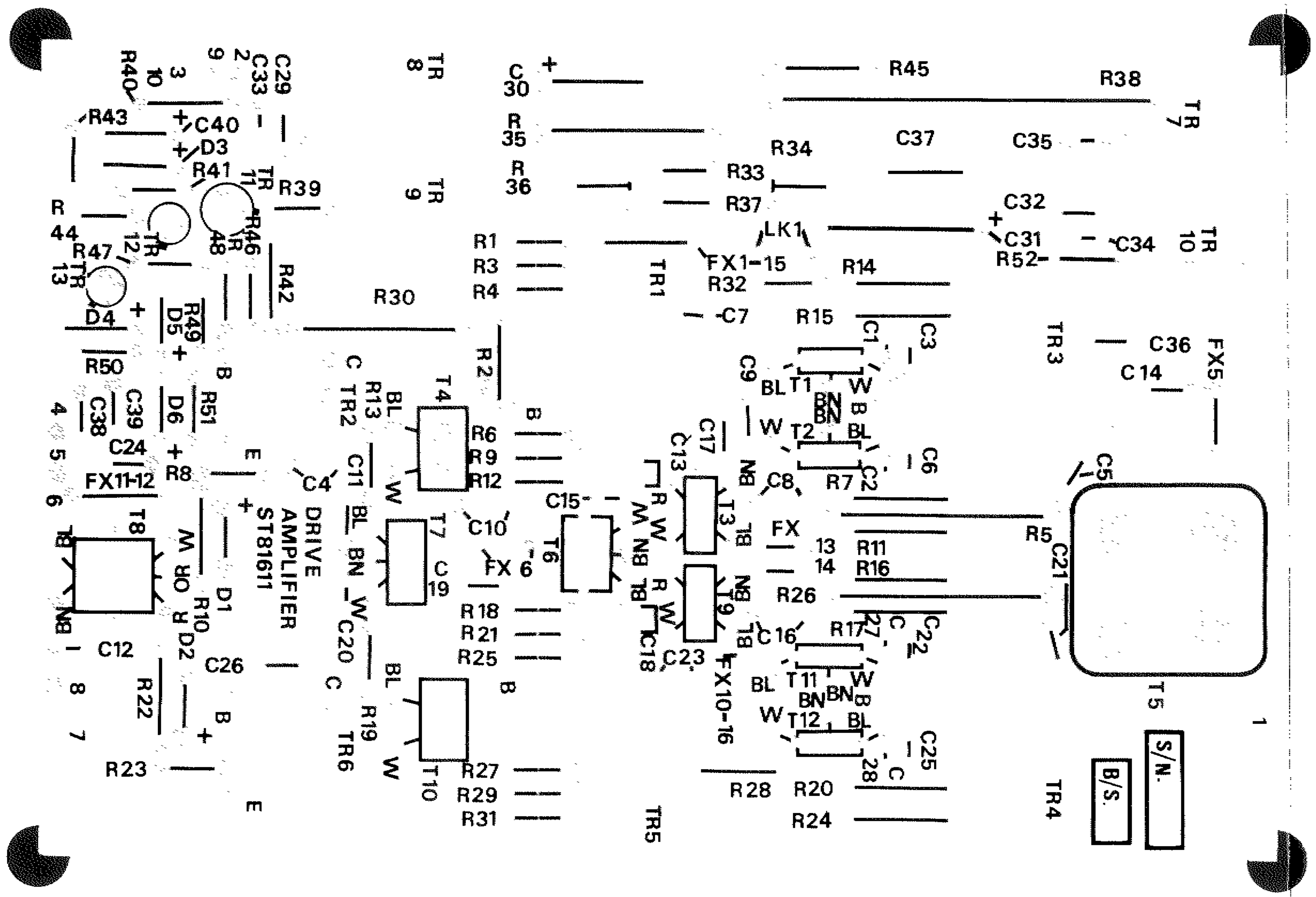
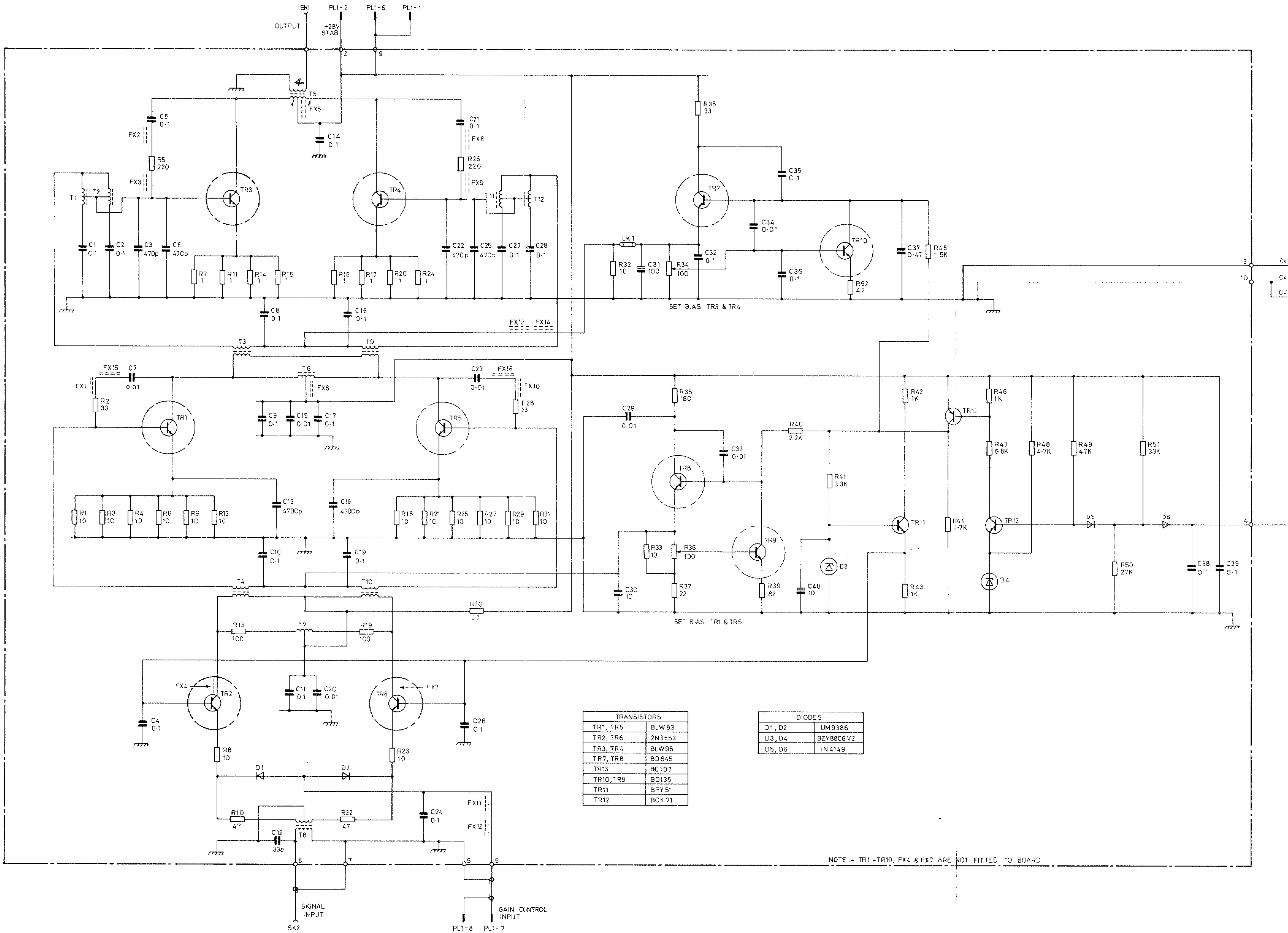


TH2354

Layout :
Drive Amplifier Board Fig.



TRANSISTORS	
TR1, TR5	BLW83
TR2, TR6	2N3553
TR3, TR4	BLW96
TR7, TR8	BD645
TR13	BC107
TR10, TR9	BD135
TR11	BFY51
TR12	BCY71

DIODES	
D1, D2	UM9386
D3, D4	BZY88C6V2
D5, D6	IN4149

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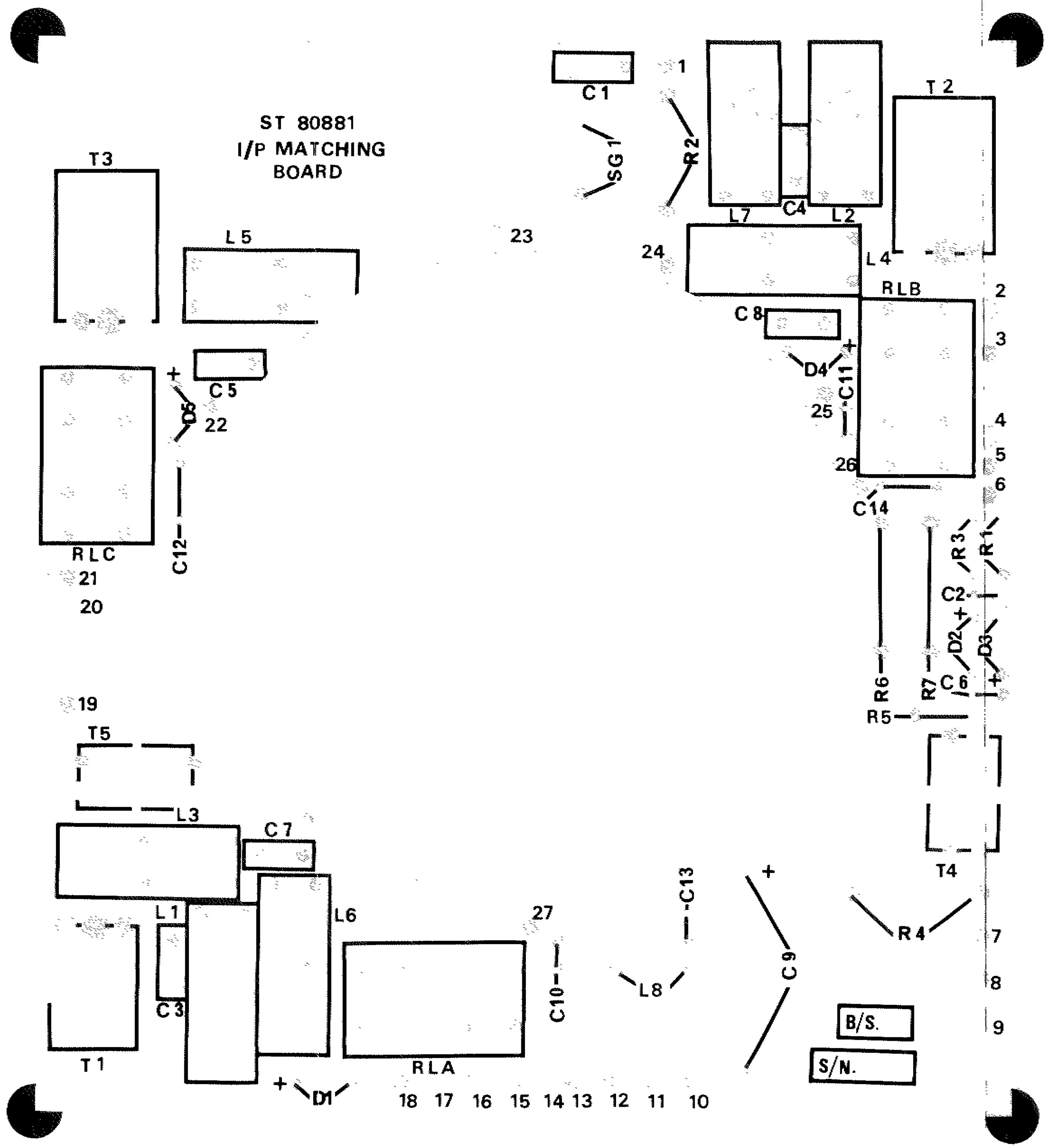
Circuit :
Drive Amplifier F



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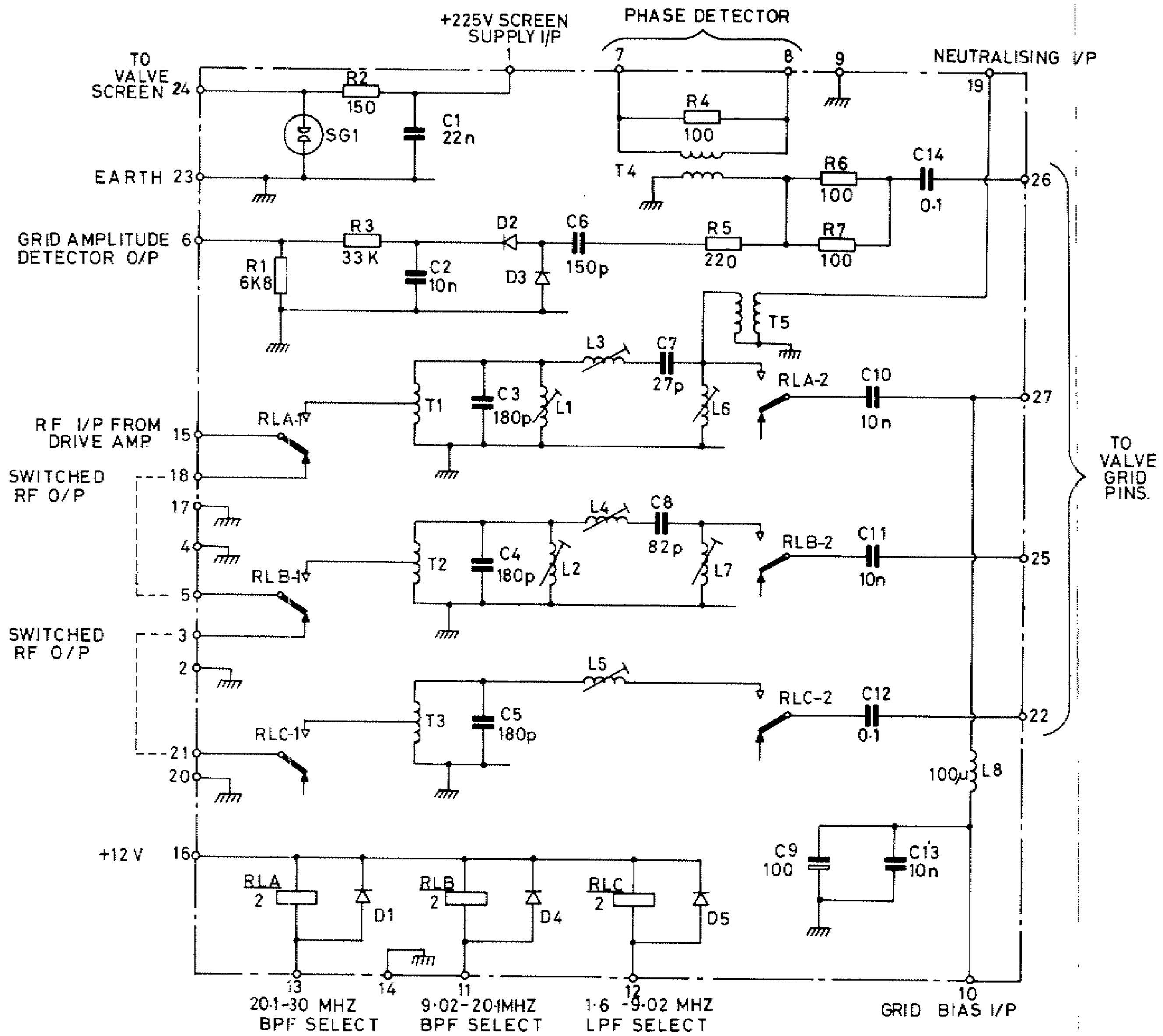
Layout:
Input Matching Board Fig. 2



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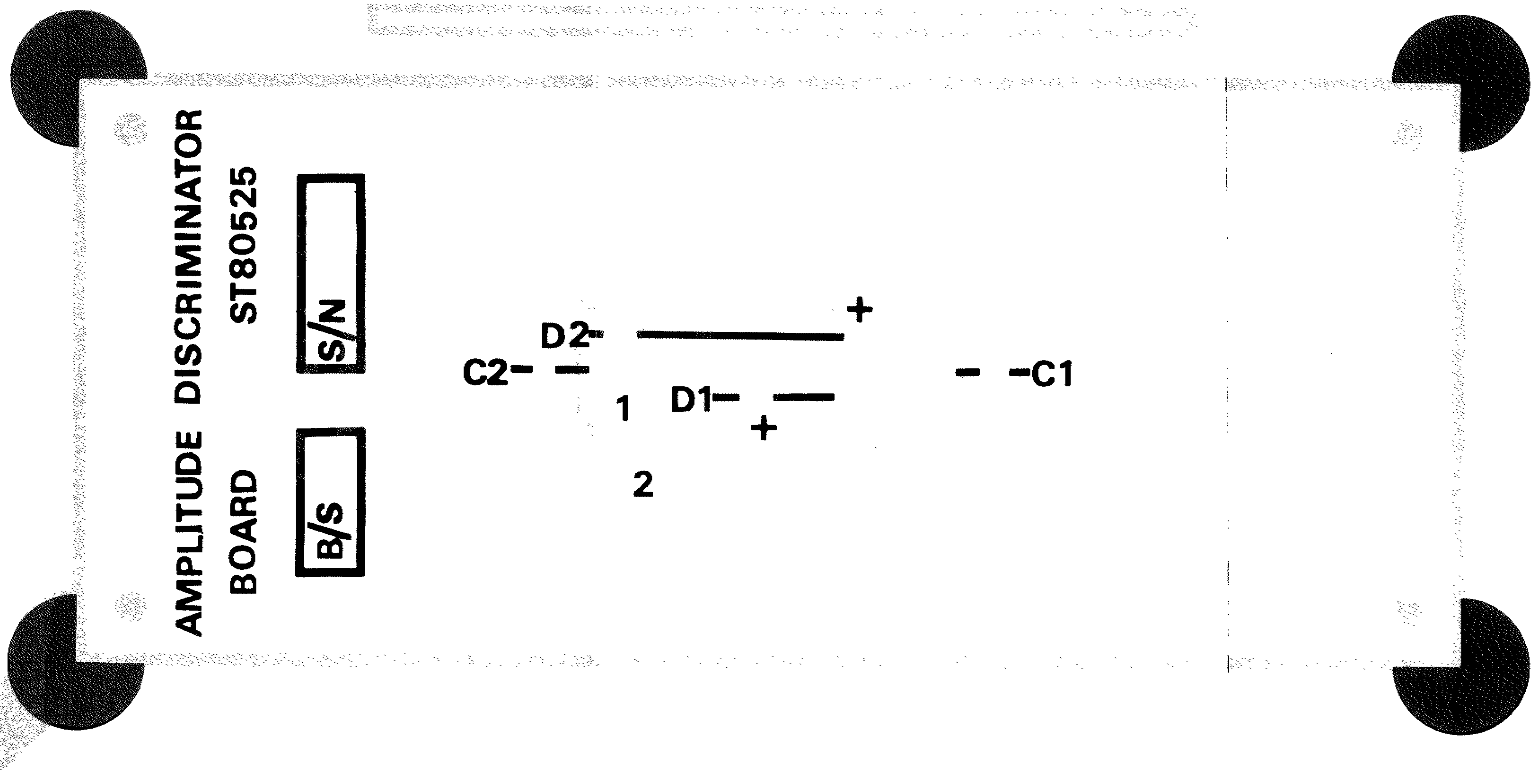
Circuit:
Input Matching Board Fig. 2



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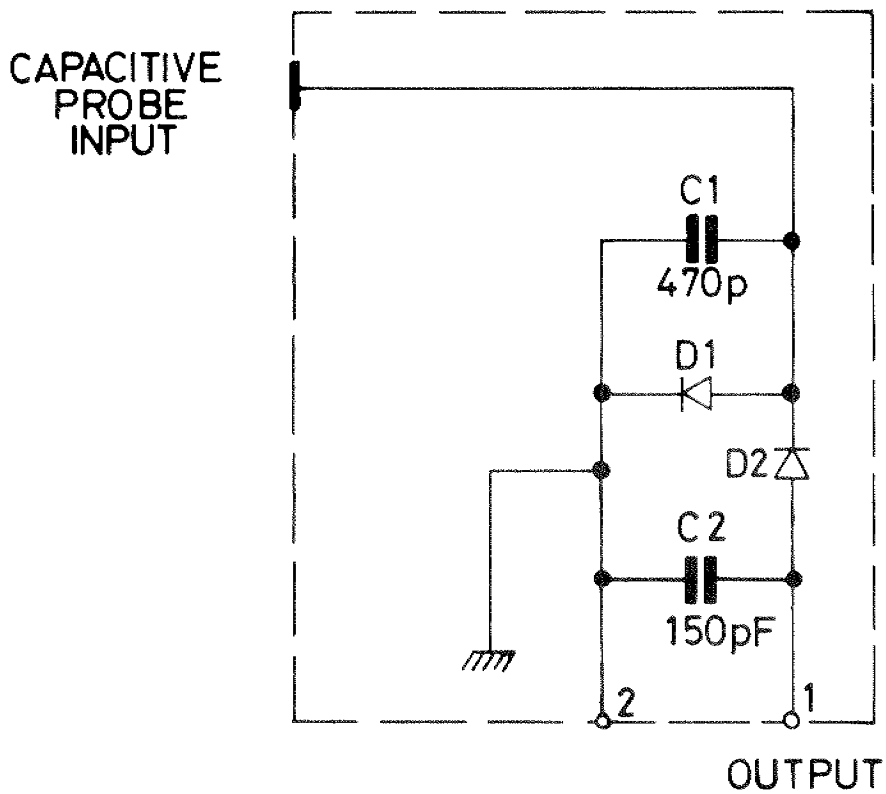
Layout :
Amplitude Discriminator Board Fig.



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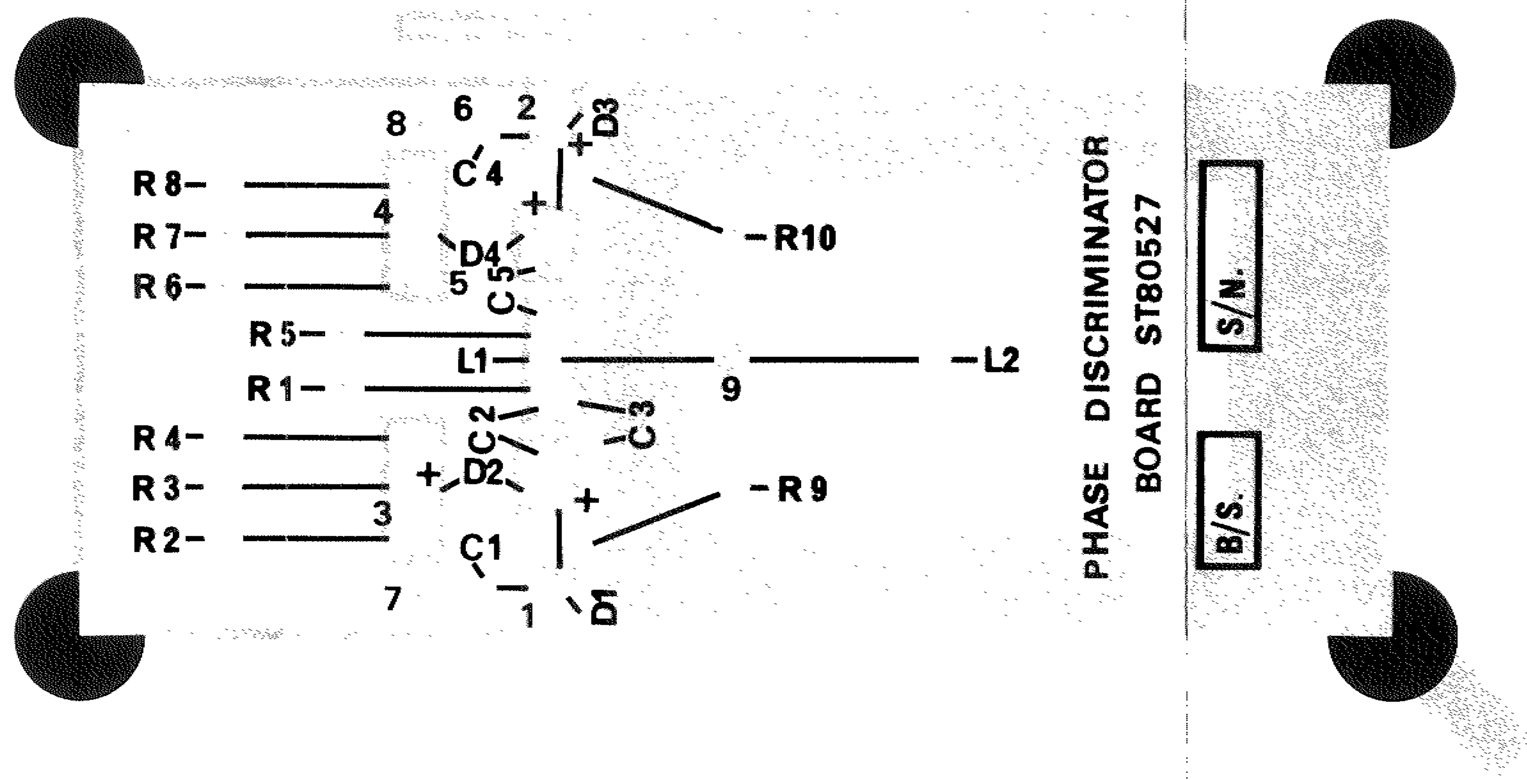
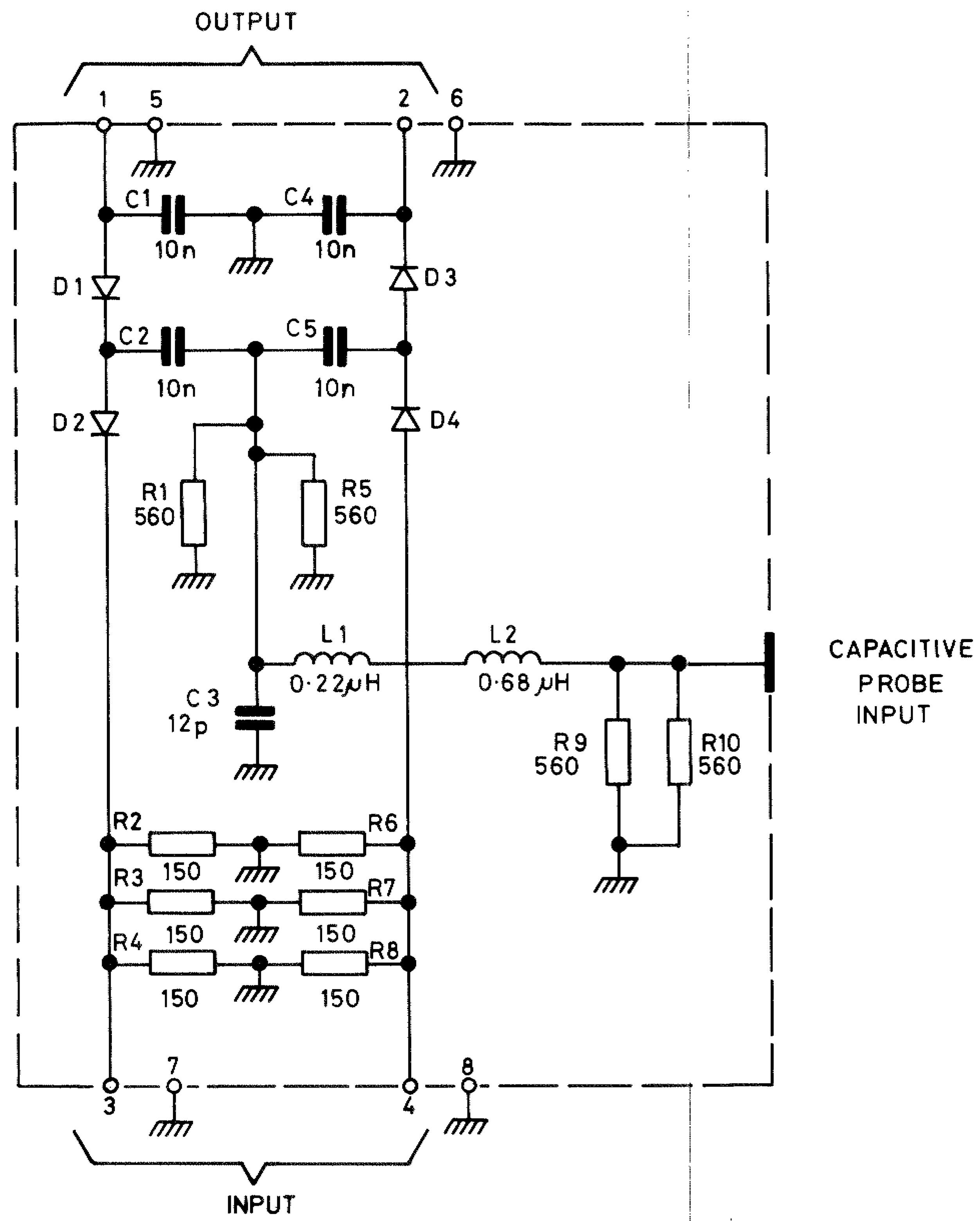
Circuit: Amplitude Discriminator Board

Fig. 27



Layout:
Phase Discriminator Board Fig.



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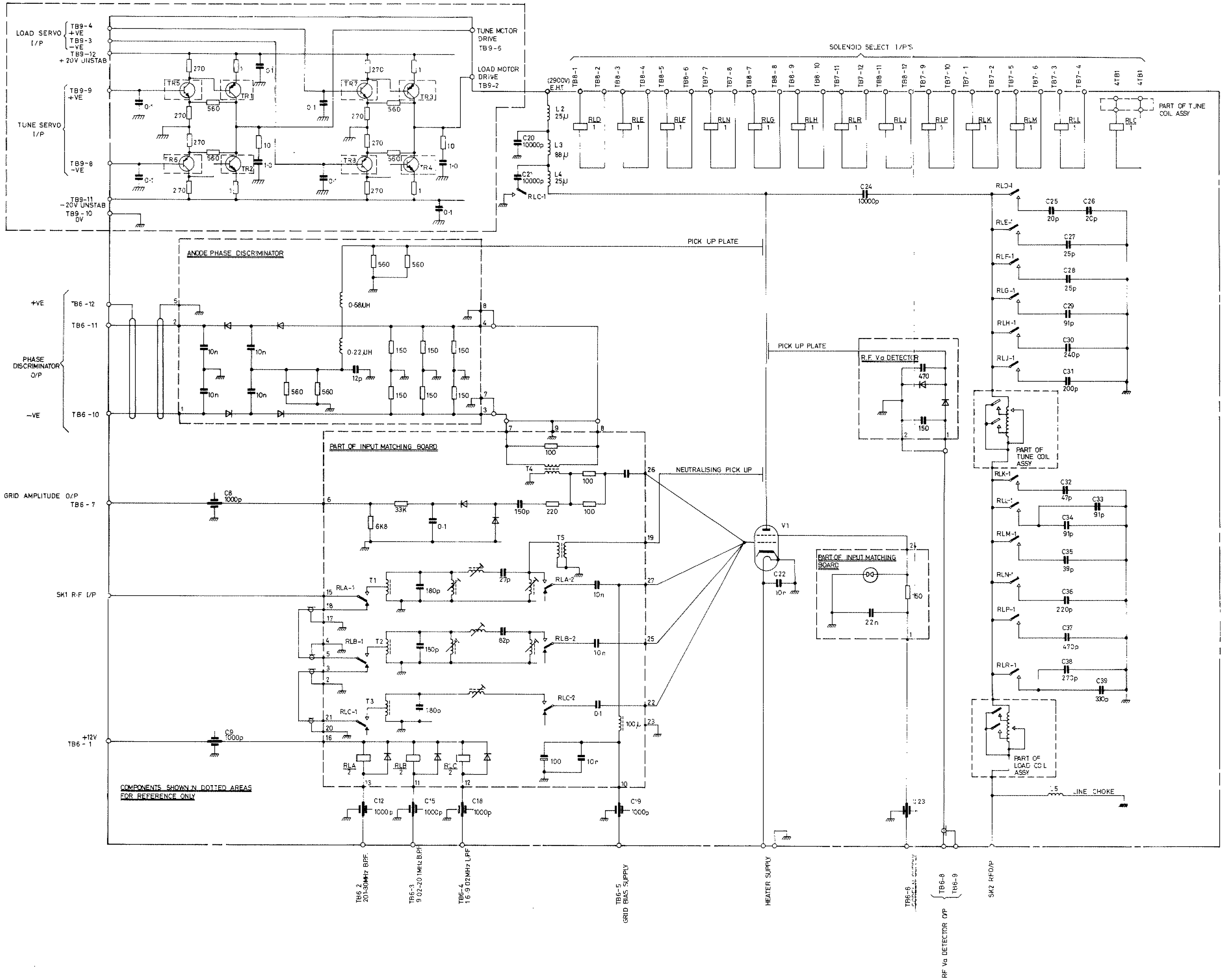
Circuit:
Phase Discriminator Board
Fig



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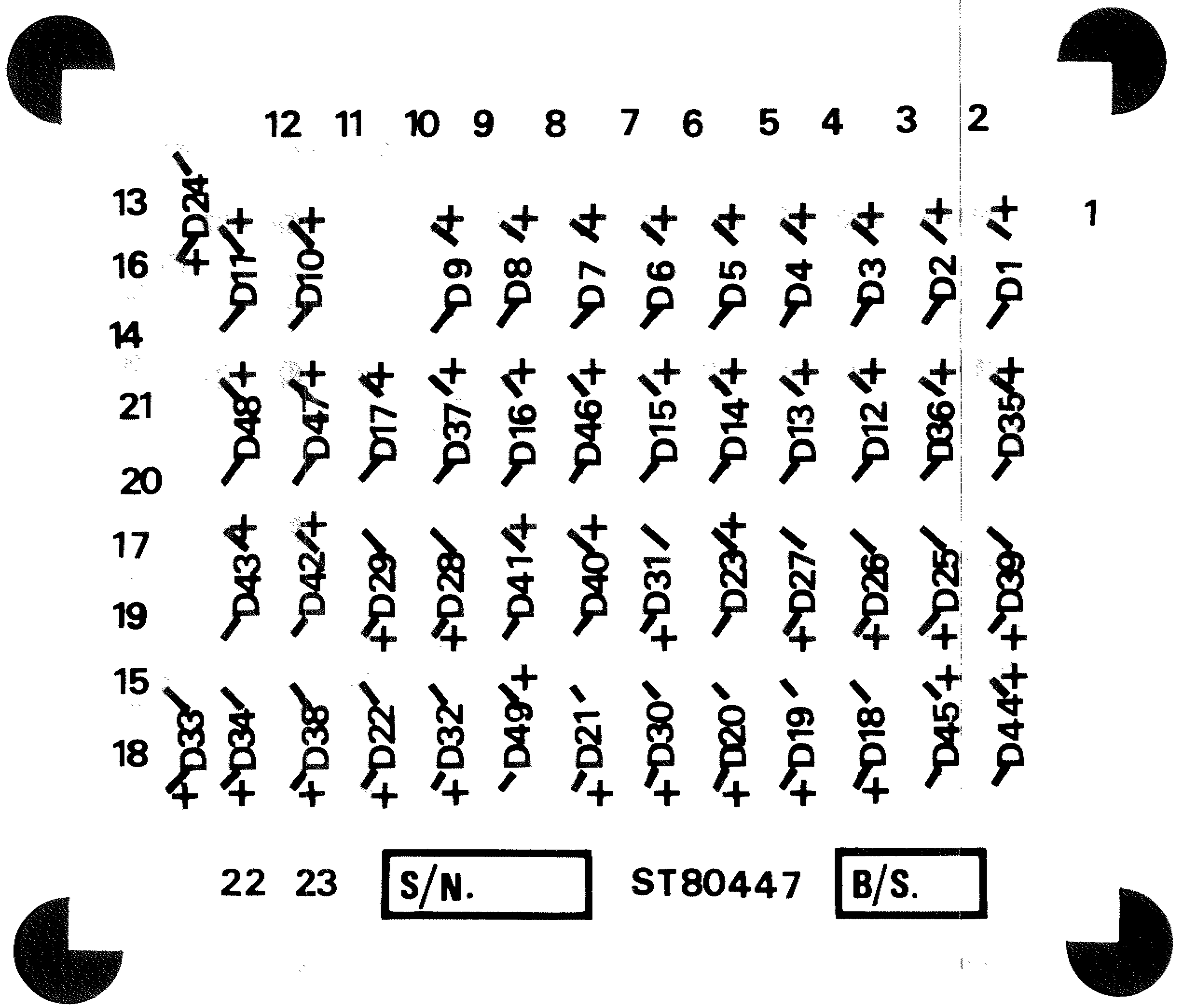
Circuit:
RF Power Amplifier Fig. 30



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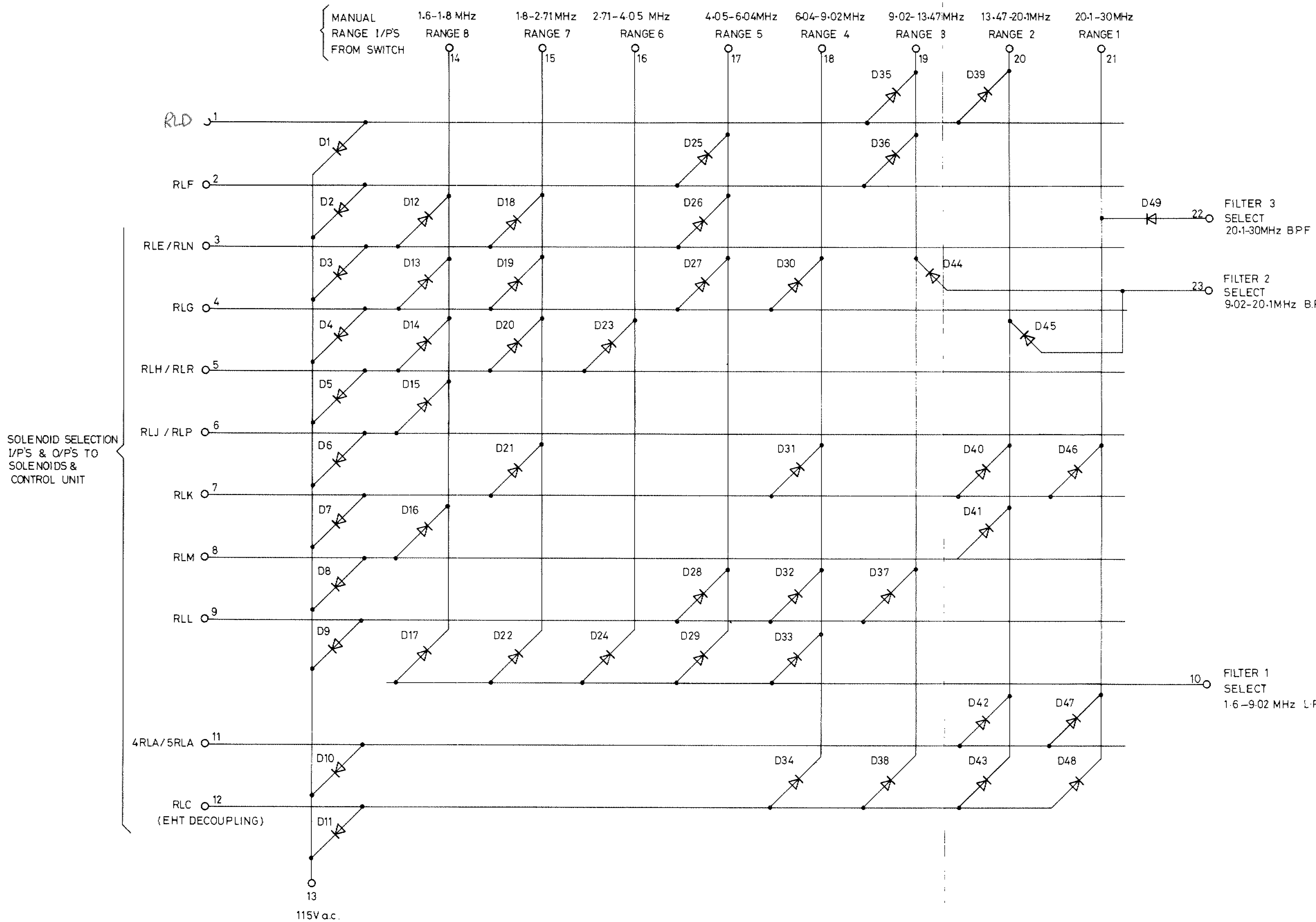
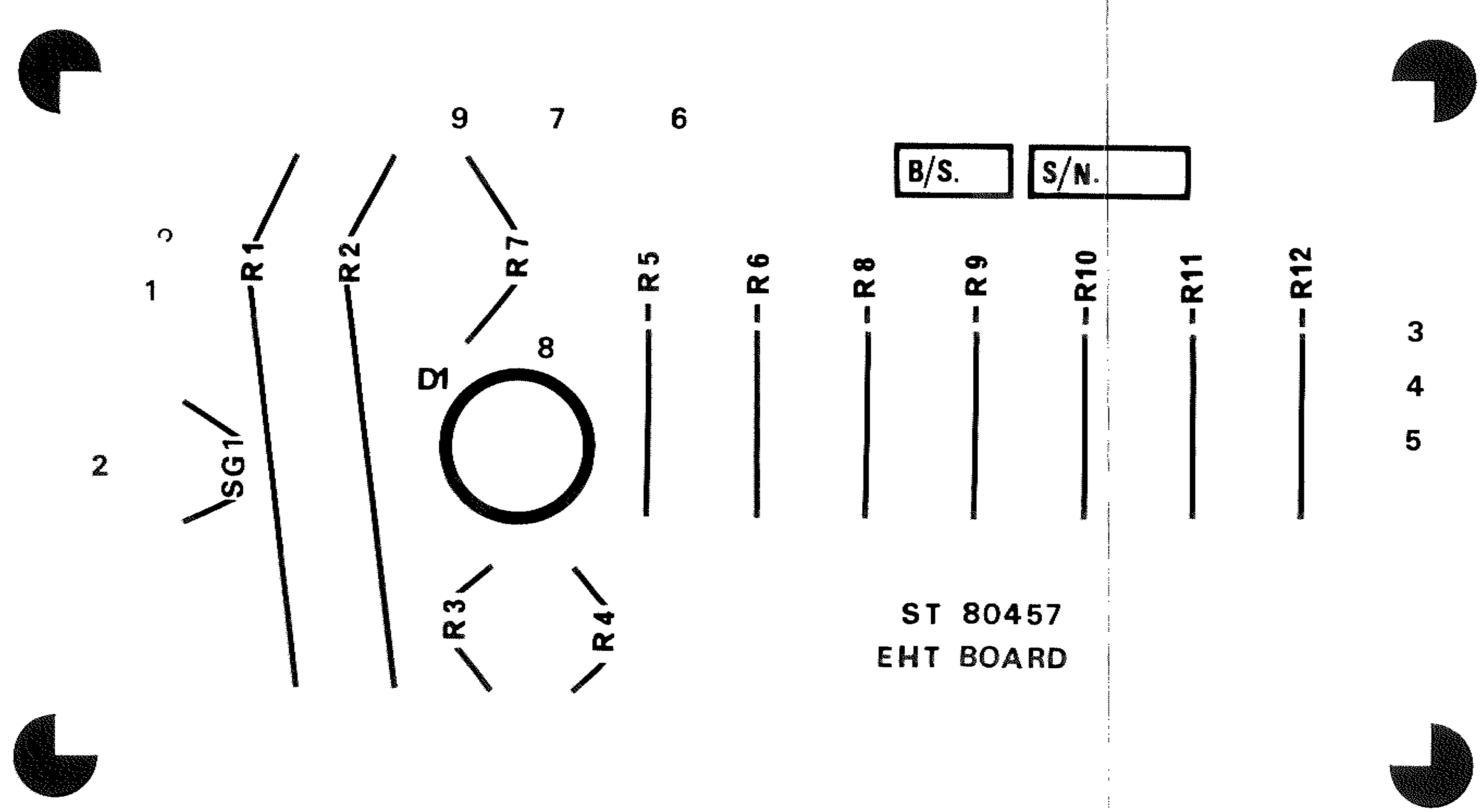
Layout :
Manual Override Board

Fig. 3



RACAL TH2354

Circuit:
Manual Override Fi



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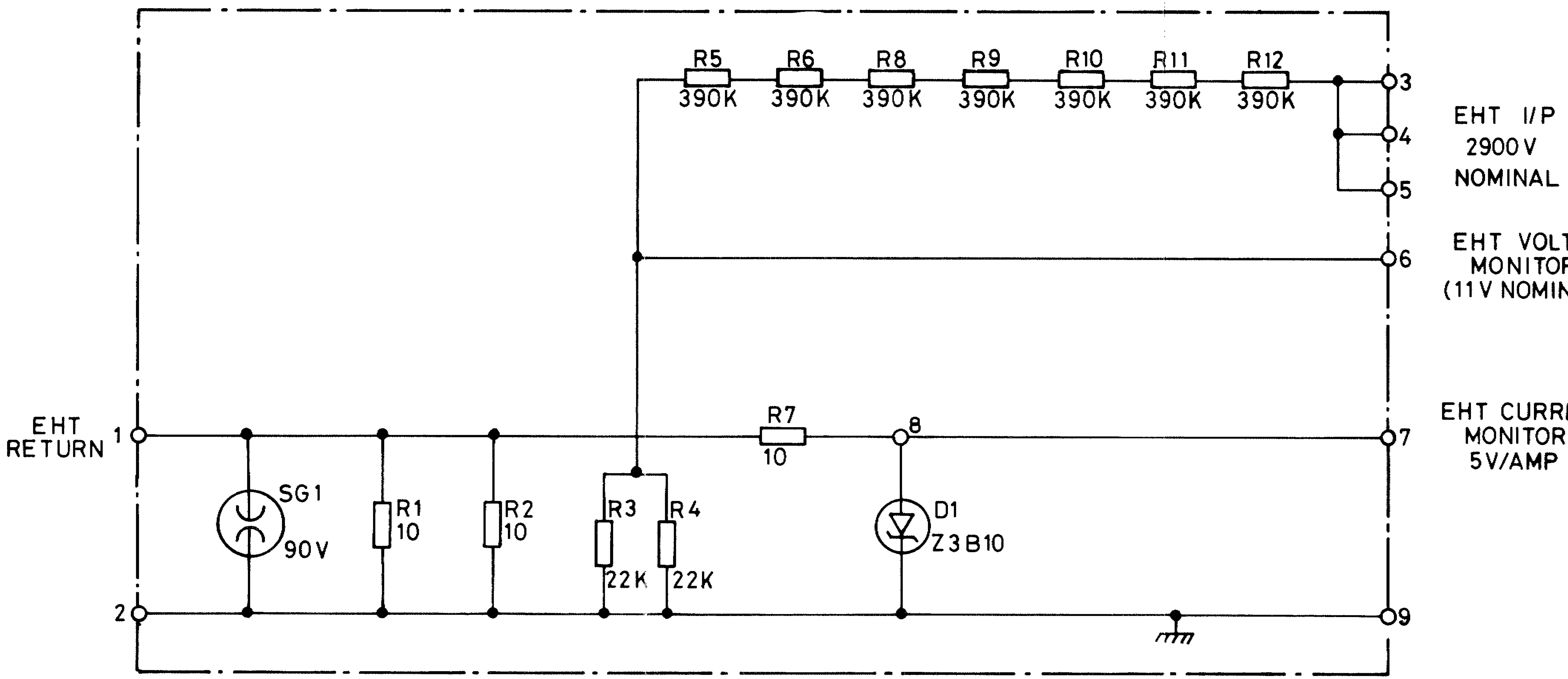
Layout:
EHT Monitor Board

Fig. 3



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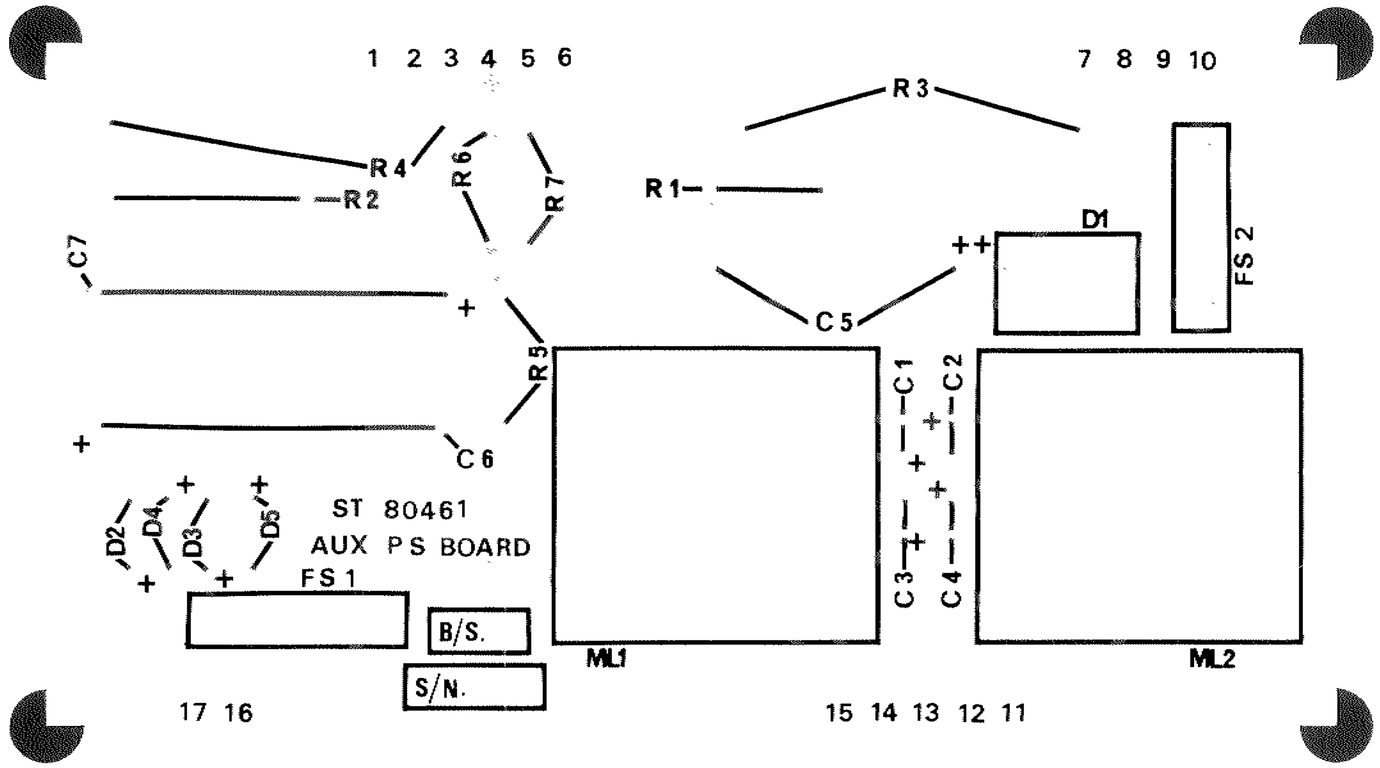
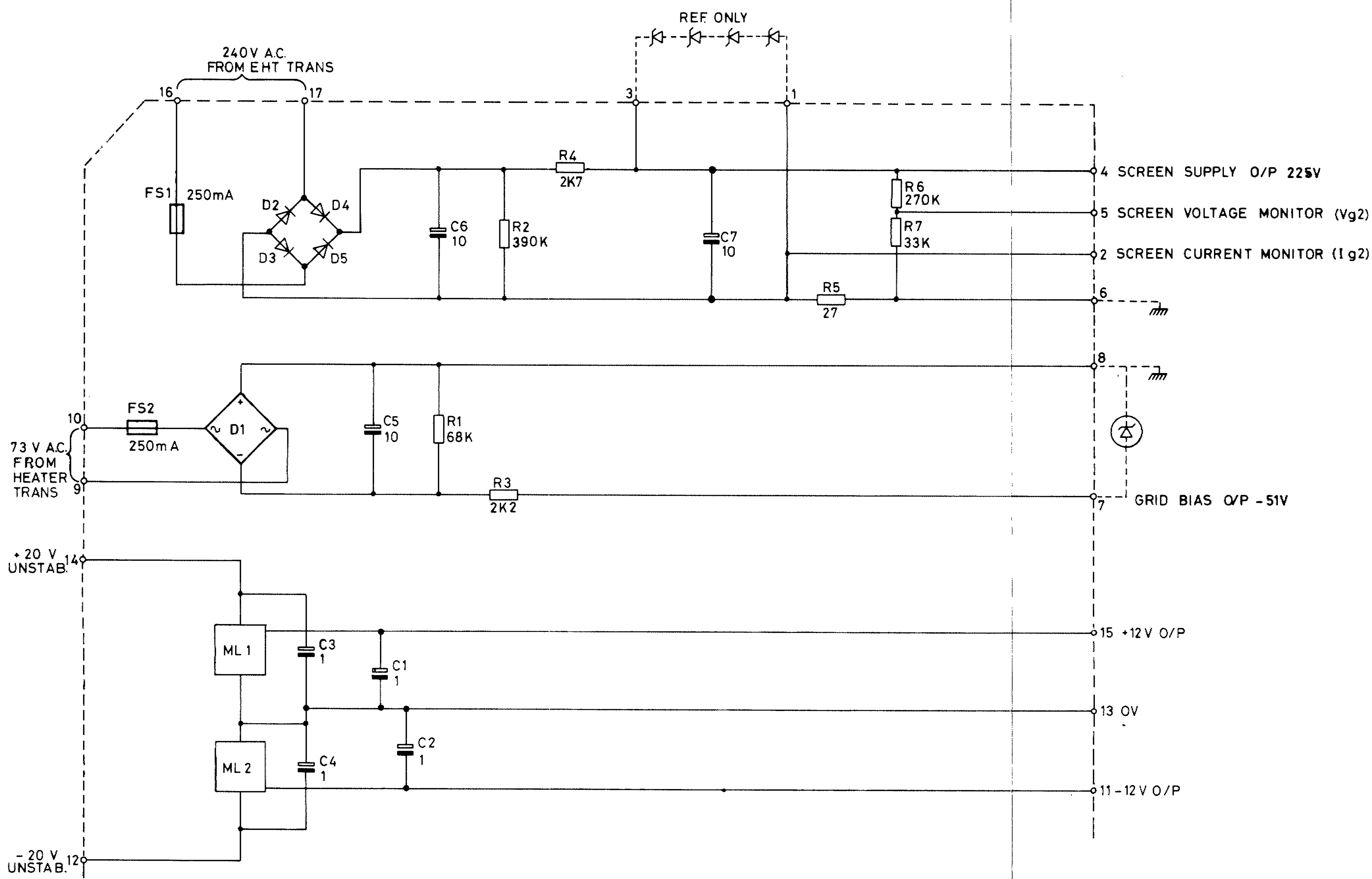
Circuit:
EHT Monitor Board

Fi



RACAL
TH 2354

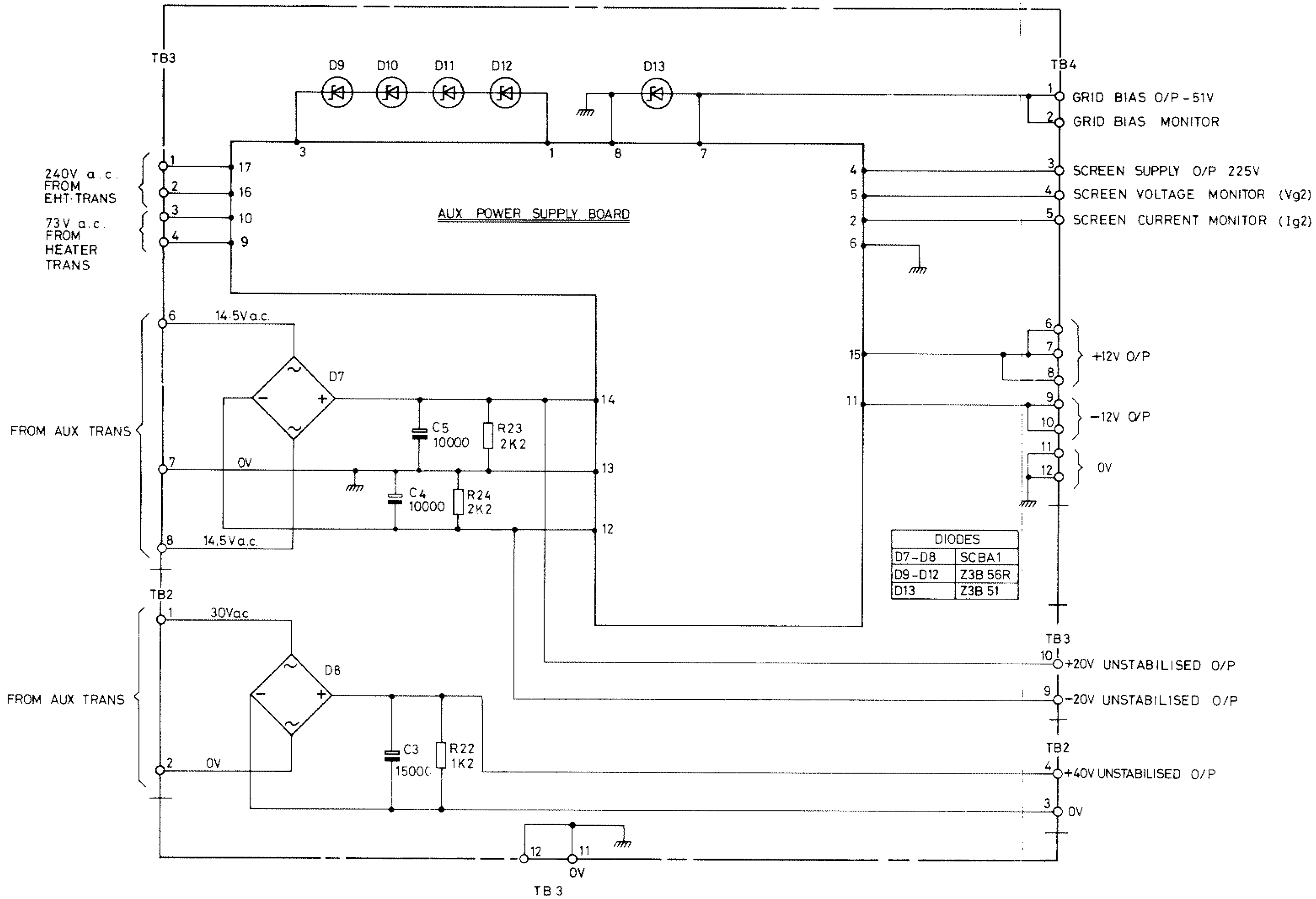
Layout :
Aux. Power Supply Board Fig.3



RACAL
TH 2354

Circuit:
Aux. Power Supply Board

Fig.3



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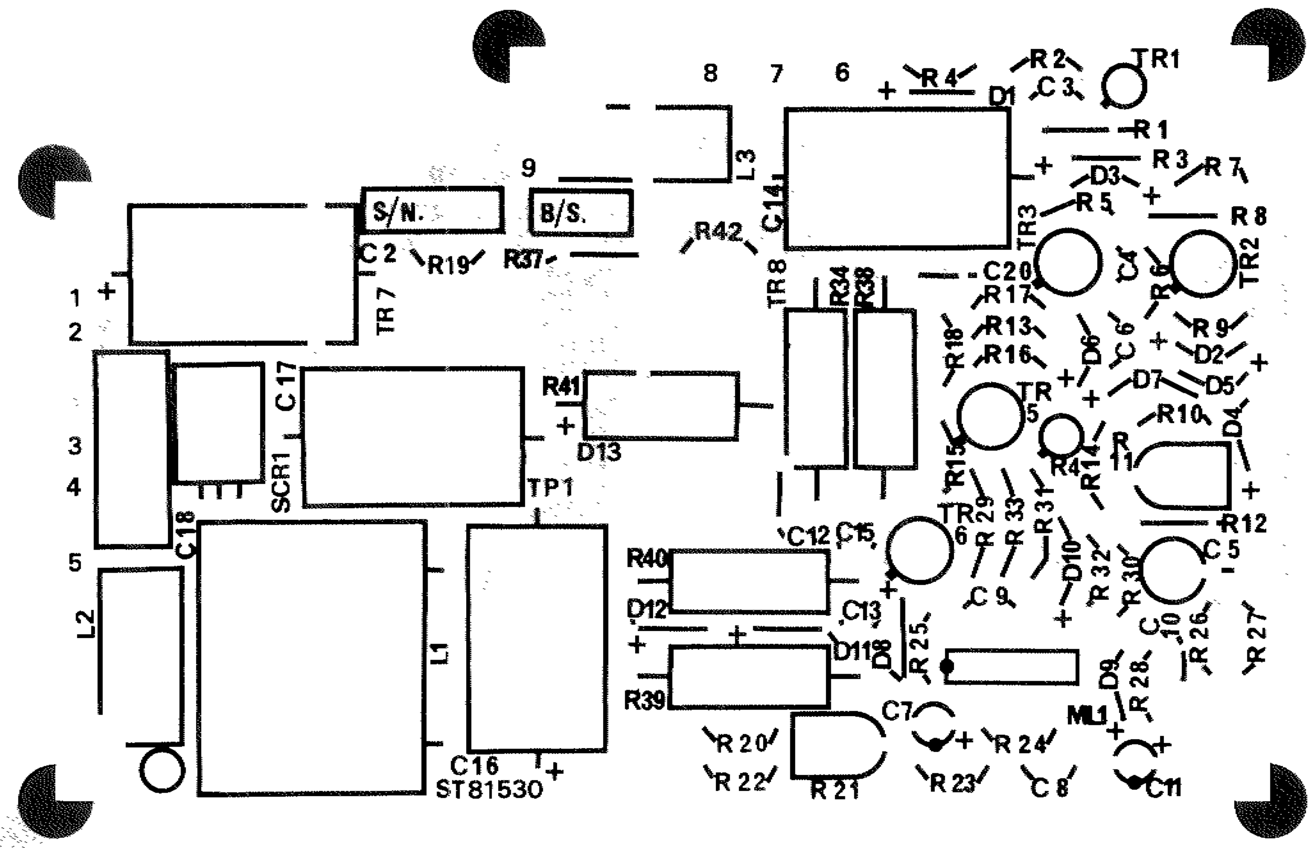
Circuit:
Power Supply Tray Fig.3



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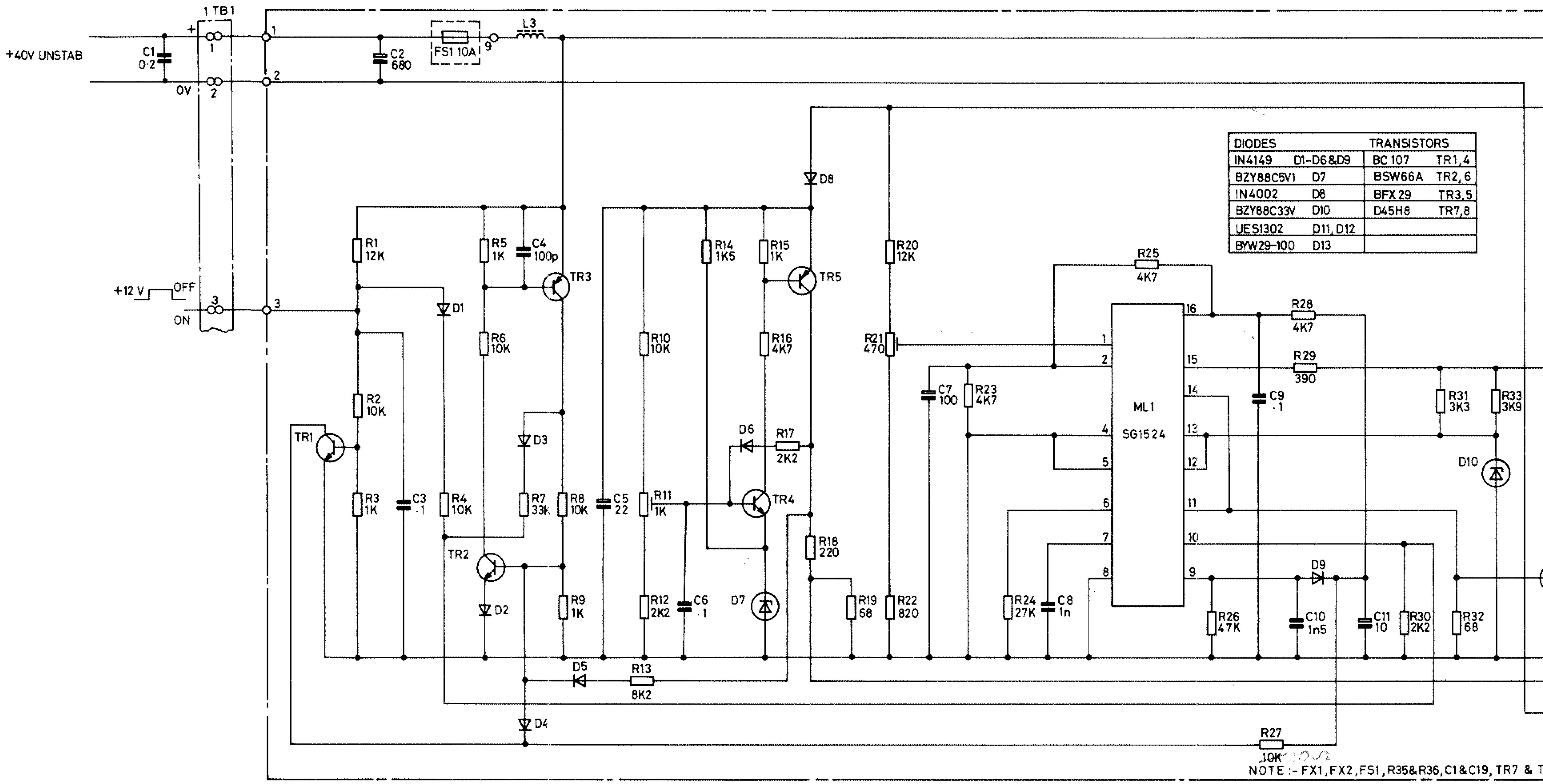
Layout :
Switched Mode Power Supply Fig.3



DIODES		TRANSISTORS	
IN4149	D1-D6&D9	BC107	TR1,4
BZY88C5V1	D7	BSW66A	TR2, 6
IN4002	D8	BFX29	TR3,5
BZY88C33V	D10	D45H8	TR7,8
UES1302	D11, D12		
BYW29-100	D13		

NOTE :- FX1, FX2, FS1, R35&R36, C1&C19, TR7 & T

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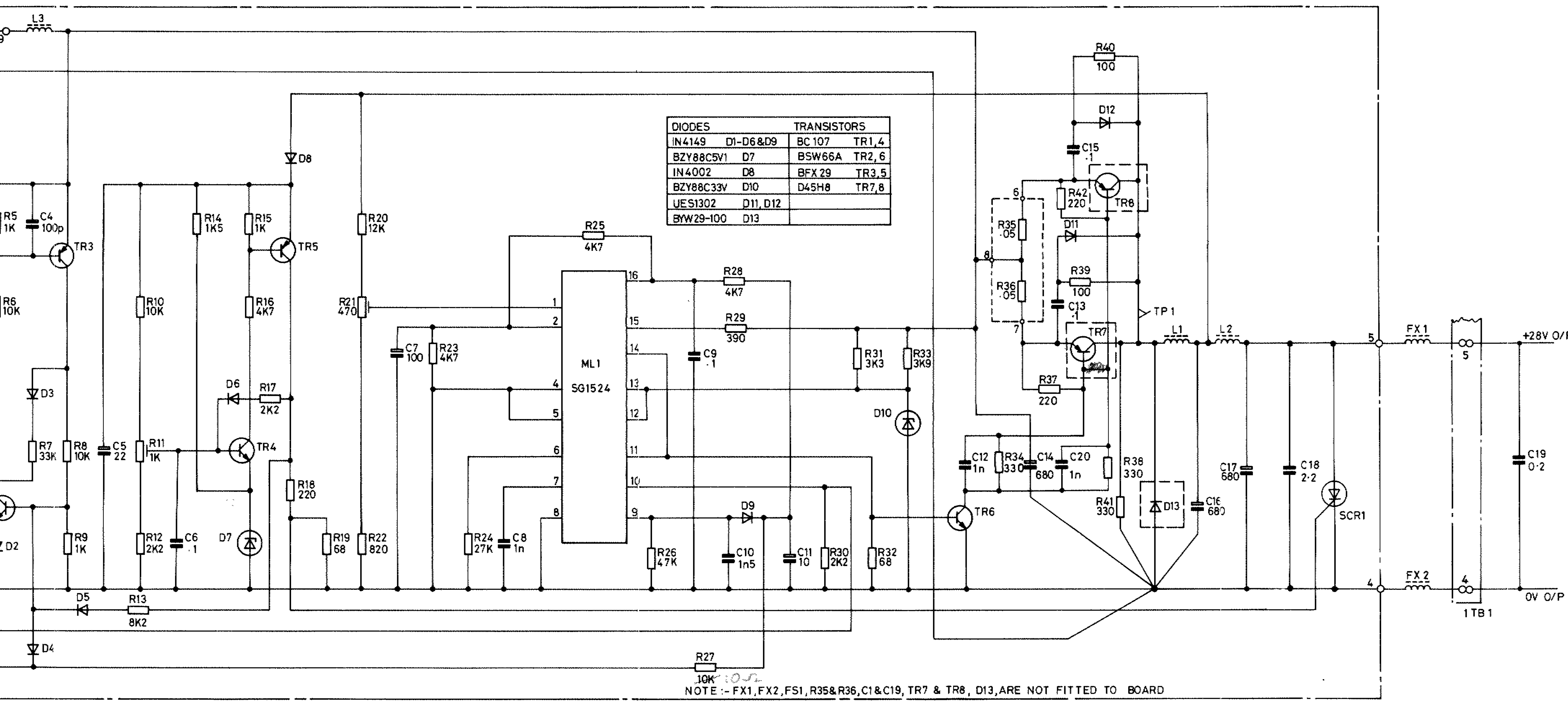
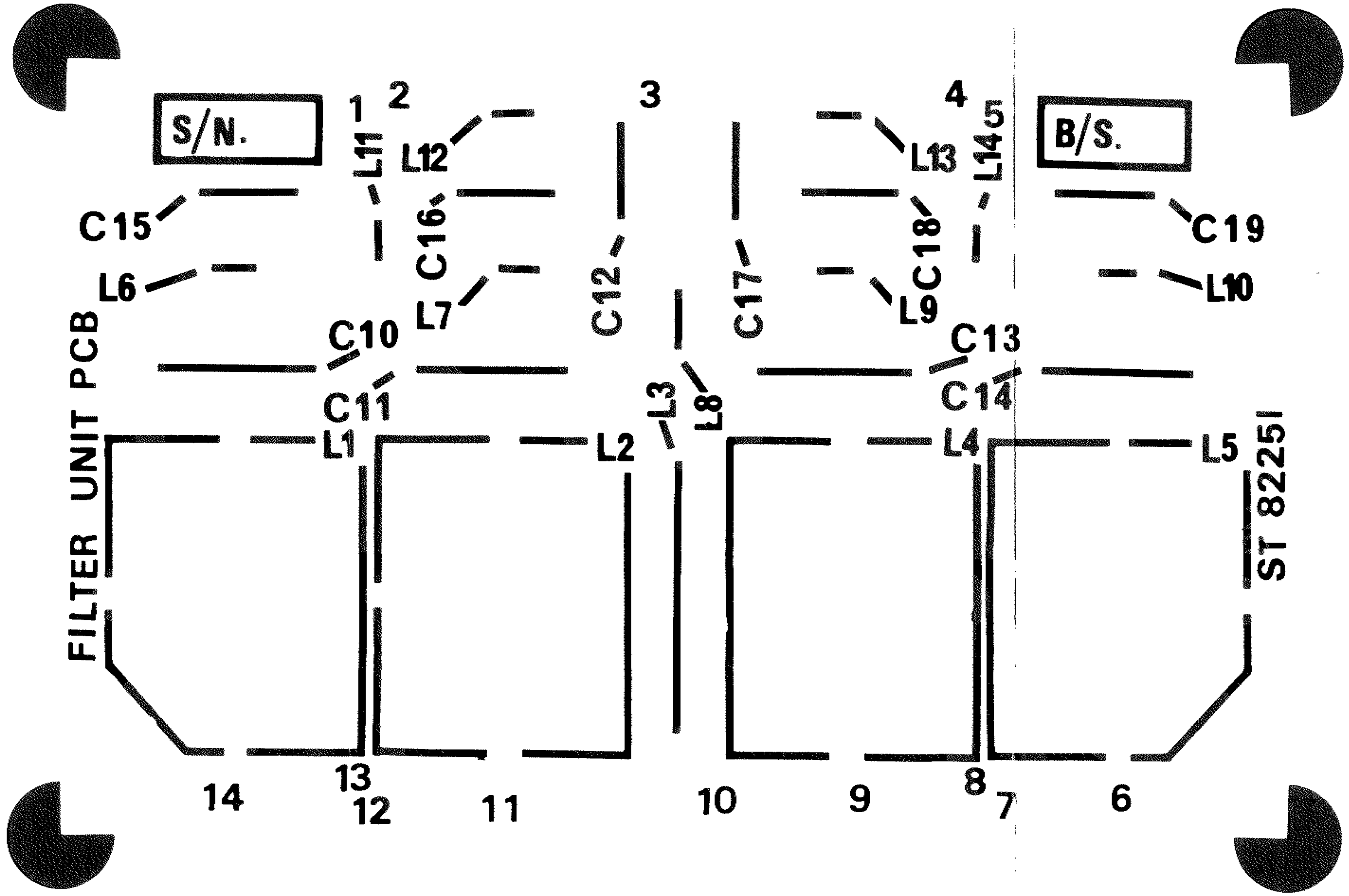
TH 2354



DIODES		TRANSISTORS	
IN4149	D1-D6&D9	BC107	TR1,4
BZY88C5V1	D7	BSW66A	TR2,6
IN4002	D8	BFX29	TR3,5
BZY88C33V	D10	D45H8	TR7,8
UES1302	D11, D12		
BYW29-100	D13		

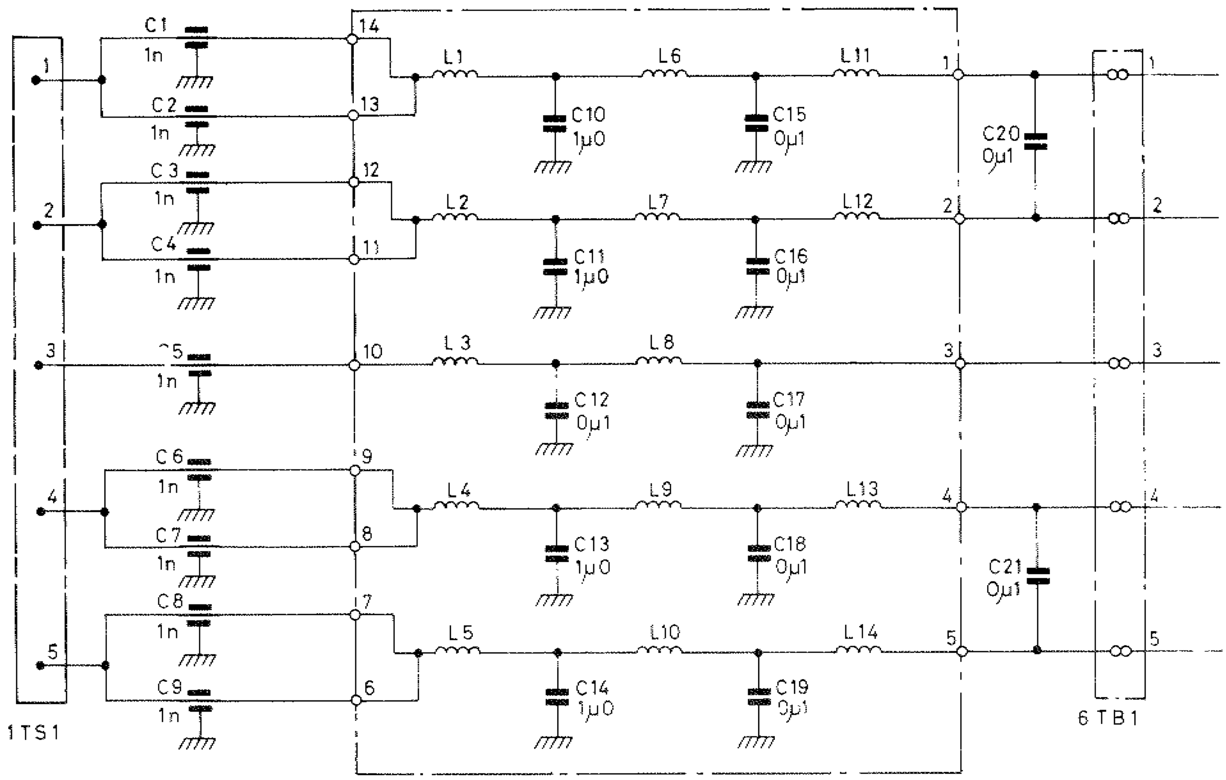
Circuit:
Switched Mode Power Supply **Fig. 39**



RACAL
TH2354

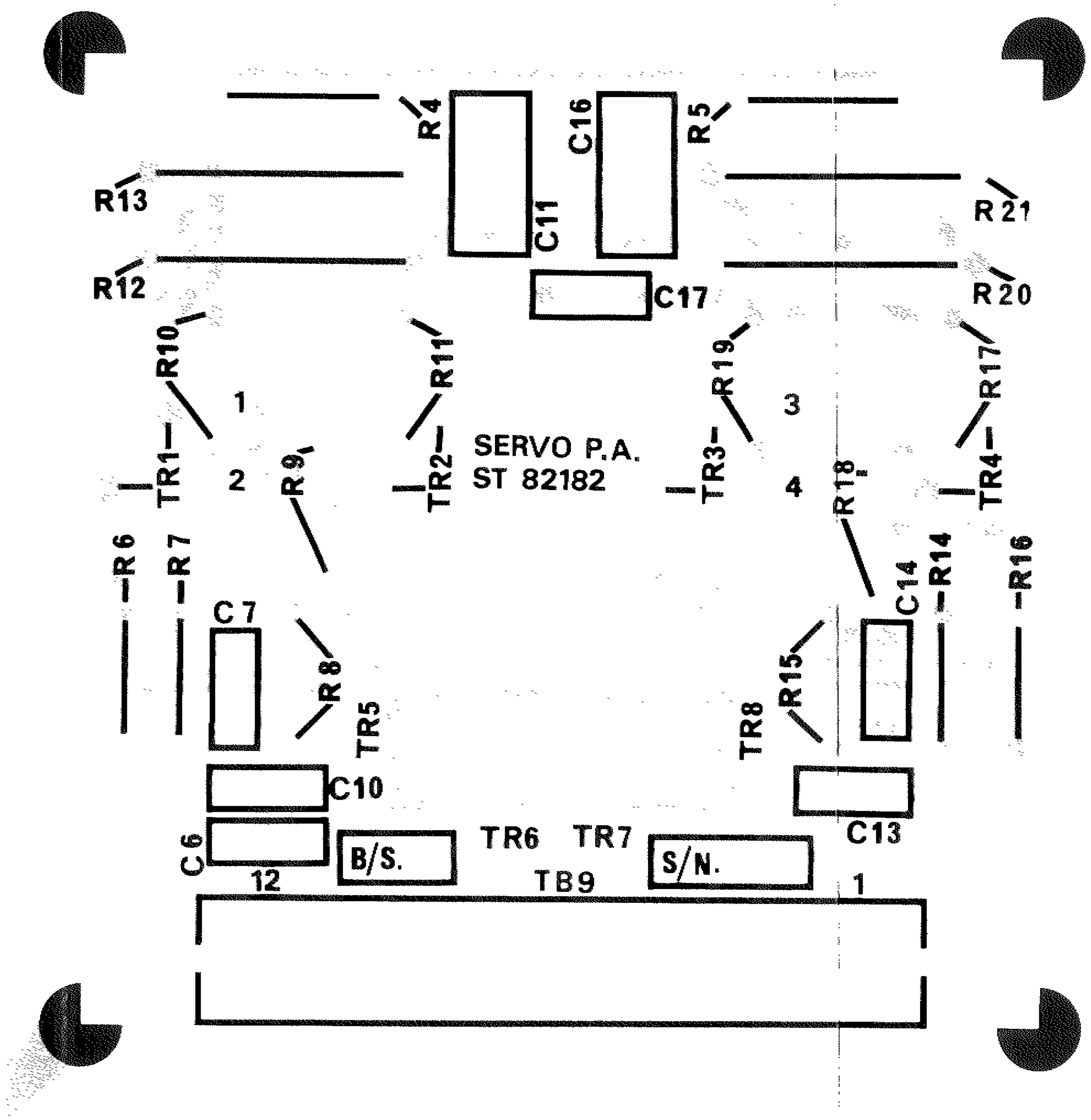
Layout:
Filter Unit

Fig. 4



Circuit: Filter Unit

Fig.41



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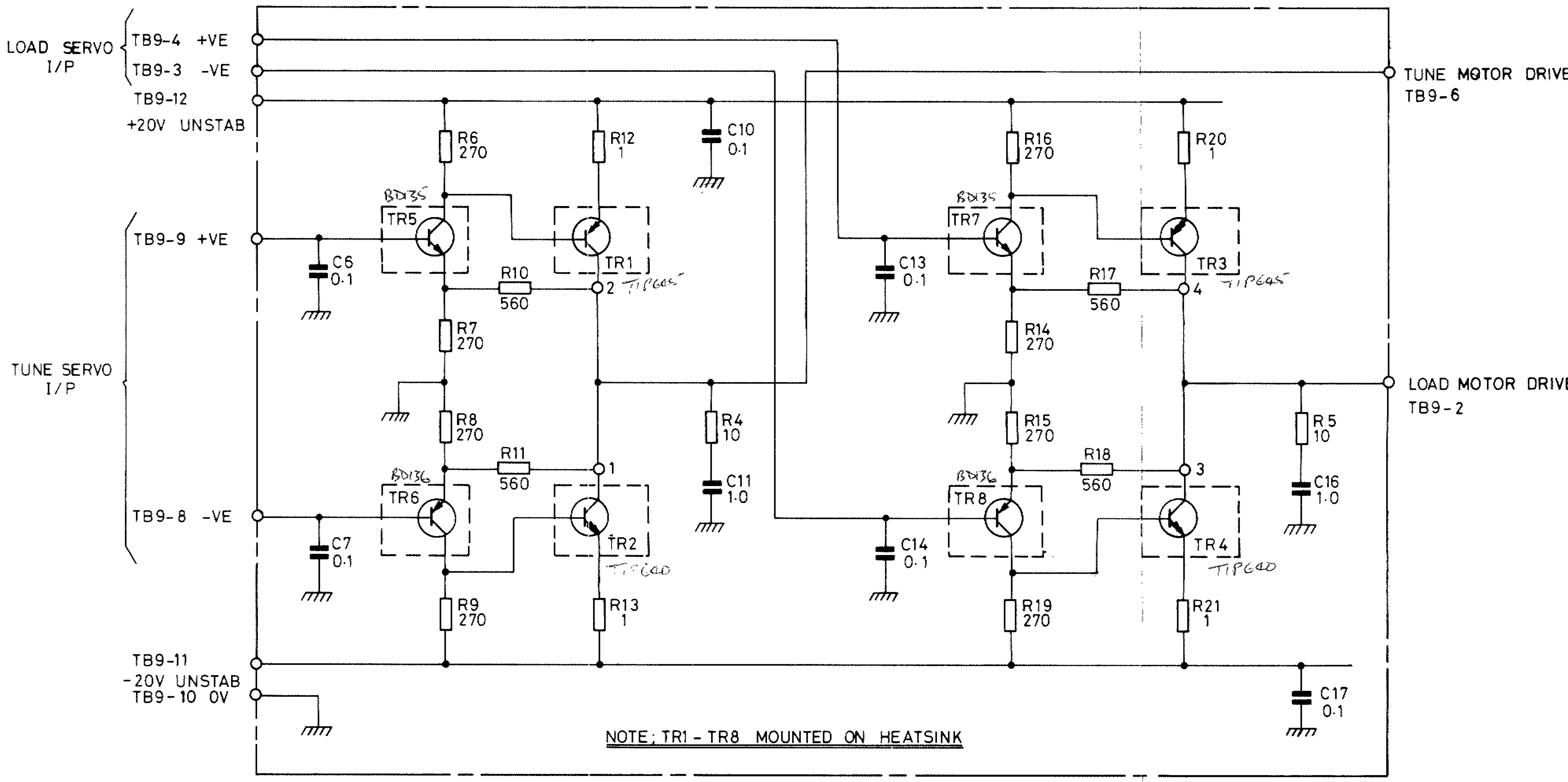
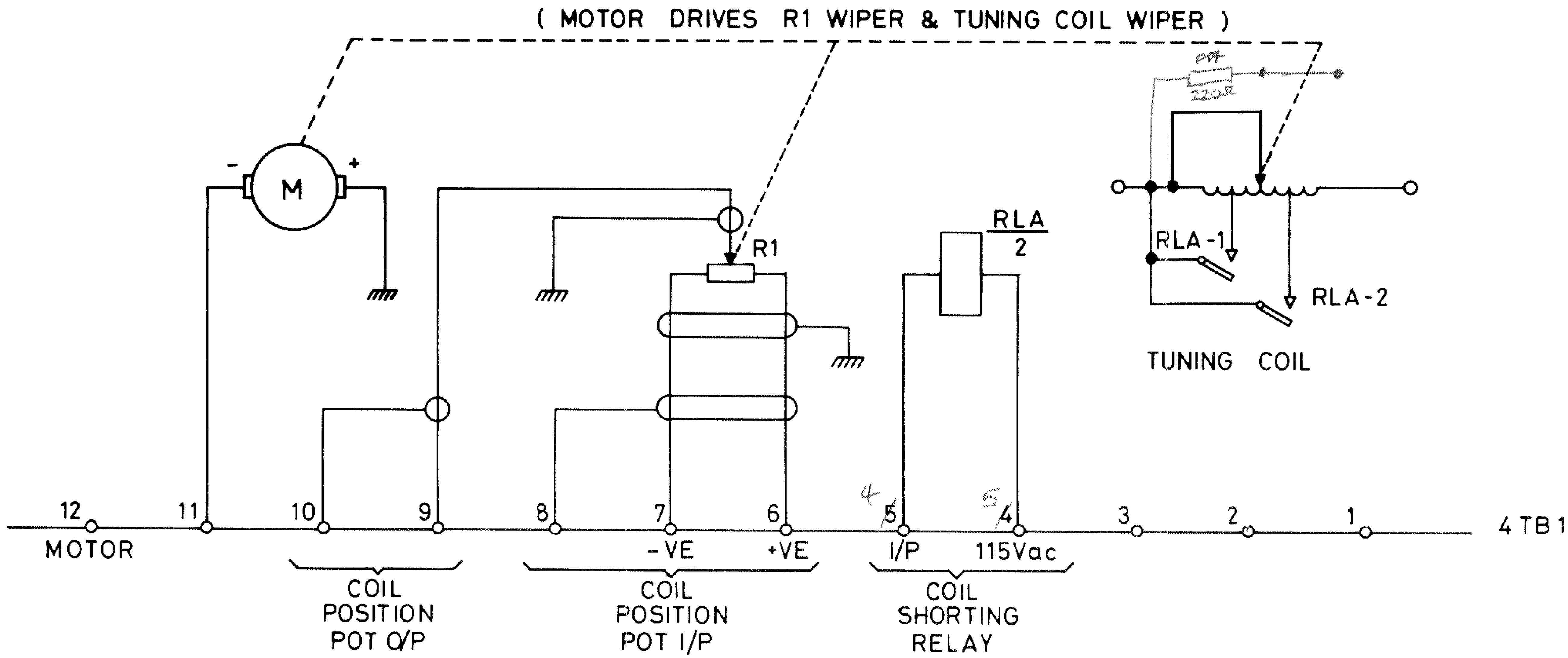
TH 2354

Layout:
Servo Power Amplifiers Fig.



RACAL
TH 2354

Circuit:
Servo Power Amplifiers Fig



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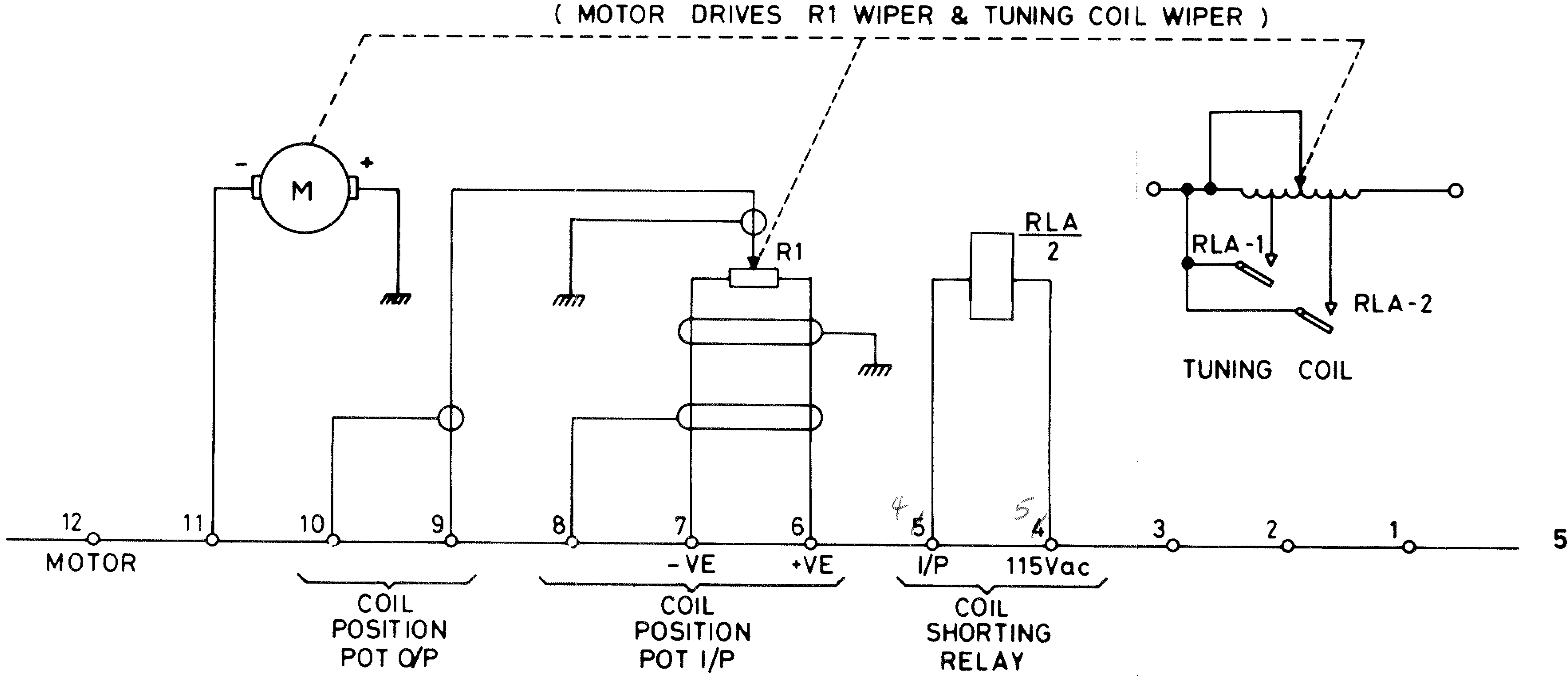
Circuit :
Tune Coil Assembly Fig



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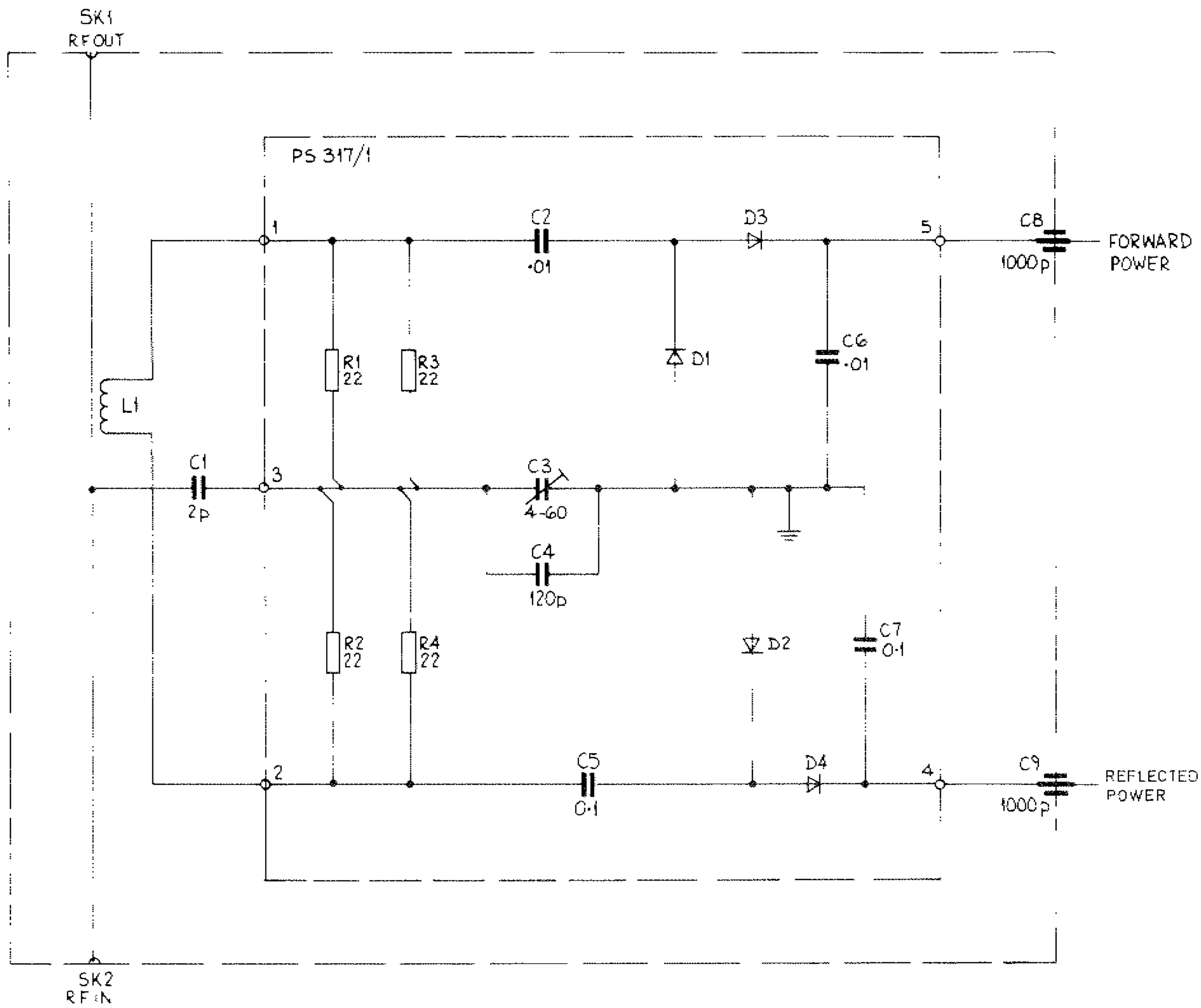
Circuit:
Load Coil Assembly Fig



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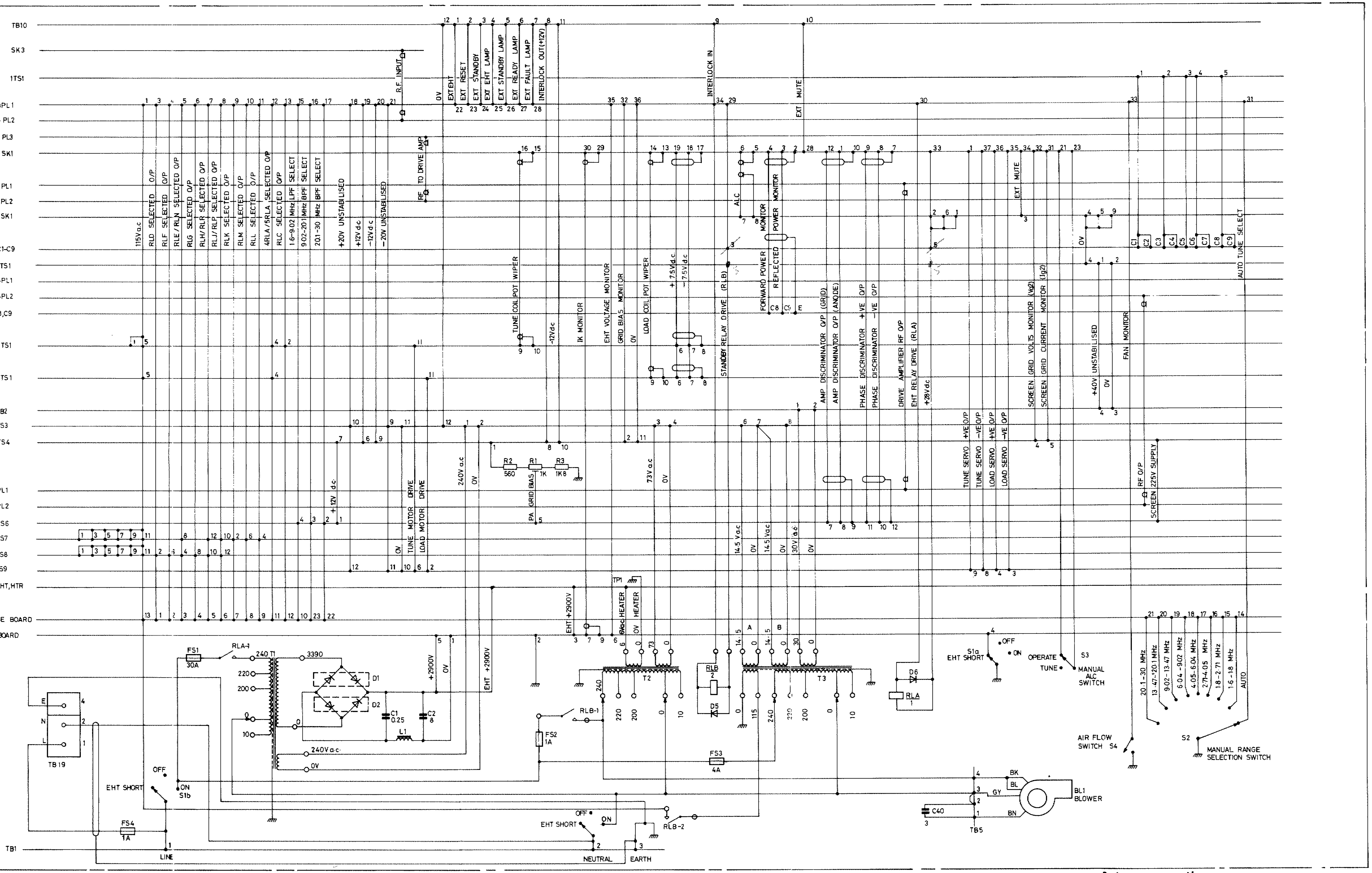
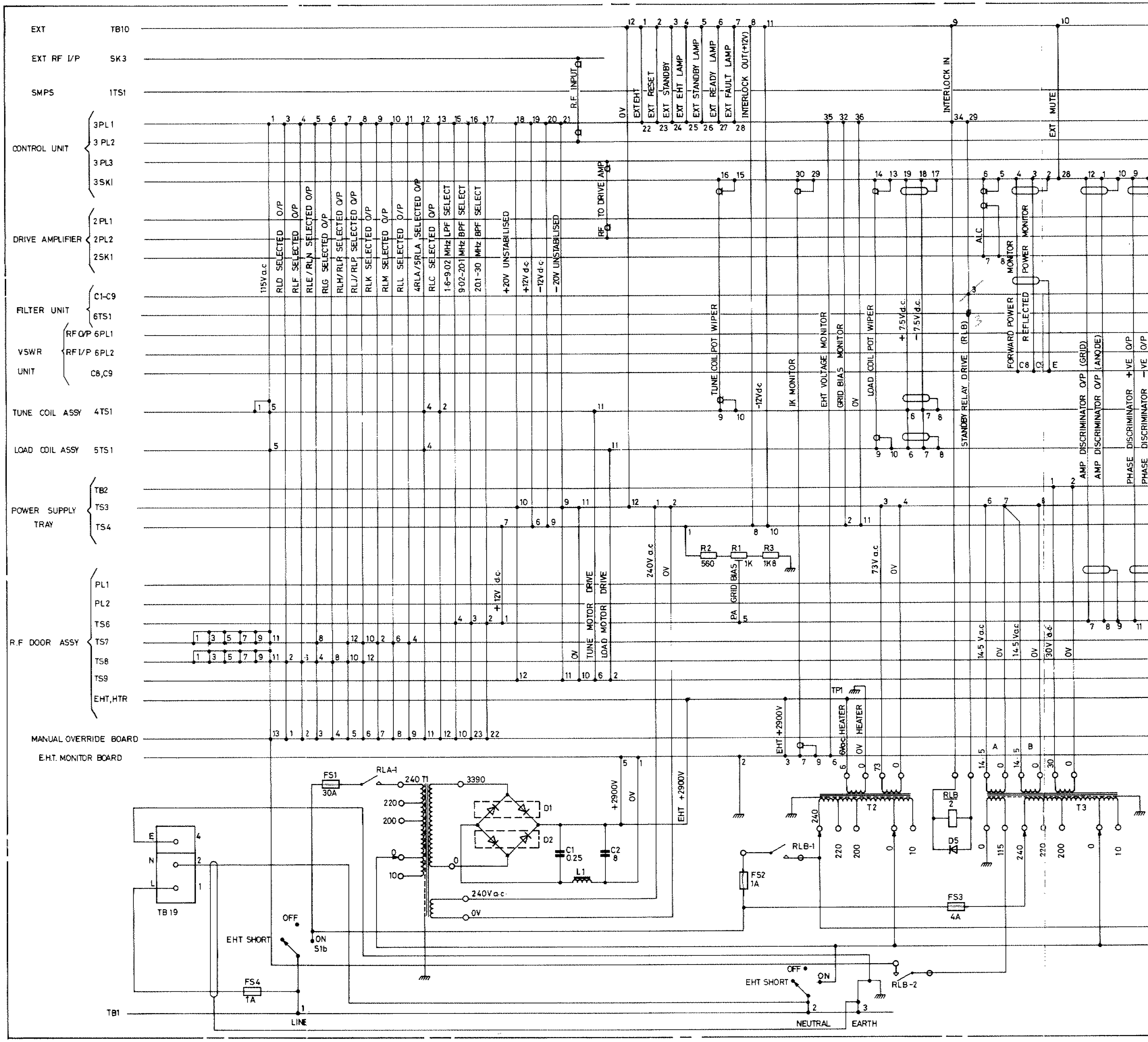
Circuit: VSWR Unit

Fig. 46



Interconnections:
TA 1823 Linear Amplifier **Fig. 47**


EXT TB10
EXT RF I/P SK3
SMPS 1TS1
CONTROL UNIT 3PL1 3PL2 3PL3 3SK1
DRIVE AMPLIFIER 2PL1 2PL2 2SK1
FILTER UNIT C1-C9 6TS1
VSWR UNIT RF O/P 6PL1 RF I/P 6PL2 C8,C9
TUNE COIL ASSY 4TS1
LOAD COIL ASSY 5TS1
POWER SUPPLY TRAY TB2 TS3 TS4
R.F DOOR ASSY PL1 PL2 TS6 TS7 TS8 TS9 EHT,HTR
MANUAL OVERRIDE BOARD
E.H.T. MONITOR BOARD
TB19
TB1
LINE
NEUTRAL
EARTH
EHT SHORT
OFF
ON
S1b
FS1 30A
FS2 1A
FS3 4A
FS4 1A
RLA-1
RLB-1
RLB-2
RLB 2
D1
D2
D5
C1 0.25
C2 8
L1
T1
T2
T3
R2 560
R1 1K
R3 1K8
240V a.c
0V
+2900V
EHT +2900V
115V a.c
+12V d.c
-12V d.c
-20V UNSTABILISED
+20V UNSTABILISED
TUNE COIL POT WIPER
LOAD COIL POT WIPER
IK MONITOR
EHT VOLTAGE MONITOR
GRID BIAS MONITOR
PA GRID BIAS
STANDBY RELAY DRIVE (RLB)
INTERLOCK IN
EXT MUTE
ALC
MONITOR
FORWARD POWER MONITOR
REFLECTED POWER MONITOR
AMP DISCRIMINATOR O/P (GRID)
AMP DISCRIMINATOR O/P (ANODE)
PHASE DISCRIMINATOR +VE O/P
PHASE DISCRIMINATOR -VE O/P
TUNE MOTOR DRIVE
LOAD MOTOR DRIVE
R.F. INPUT
RF TO DRIVE AMP
EXT EHT
EXT RESET
EXT STANDBY
EXT EHT LAMP
EXT STANDBY LAMP
EXT READY LAMP
EXT FAULT LAMP
INTERLOCK OUT (+12V)
RLD SELECTED O/P
RLF SELECTED O/P
RLE/RLN SELECTED O/P
RLG SELECTED O/P
RLH/RLR SELECTED O/P
RLJ/RLP SELECTED O/P
RLK SELECTED O/P
RLM SELECTED O/P
RLL SELECTED O/P
4RLA/5RLA SELECTED O/P
RLC SELECTED O/P
1.6-9.02 MHz LPF SELECT
9.02-20.1 MHz BPF SELECT
20.1-30 MHz BPF SELECT
+7.5V d.c
-7.5V d.c
73V a.c
14.5 V a.c
30V a.c
6V a.c HEATER
0V HEATER
TP1
240V a.c
3390

RACAL COMMUNICATIONS LTD

Amendment to

TA 1823 AUTO-TUNE HF LINEAR AMPLIFIER

(CR 67628 & RM MEMO)

CHAPTER 3

Page 3-1 Para 3 (2), Page 3-2 Para 4(7), Page 3-5 Para 8(6)

Amend SUPPLY to read POWER

CHAPTER 11

Page 11-1

Insert heading for para 2:- REMOVAL OF FRONT PANEL
Add to para 3(1):- (para 2).

CHAPTER 13 COMPONENTS LISTS

Page 13-5

Between FS2 and FS3 insert:- FS4 1 A Fuselink 928133

Page 13-9

Amend tolerance of C27 to read:- 20

Page 13-48

Amend value rating & part number of C13, C15 to read:- 100 n 50 V 938786

ILLUSTRATIONS

FIGURE 2

Add component identification TB1 and FS4 as shown below.

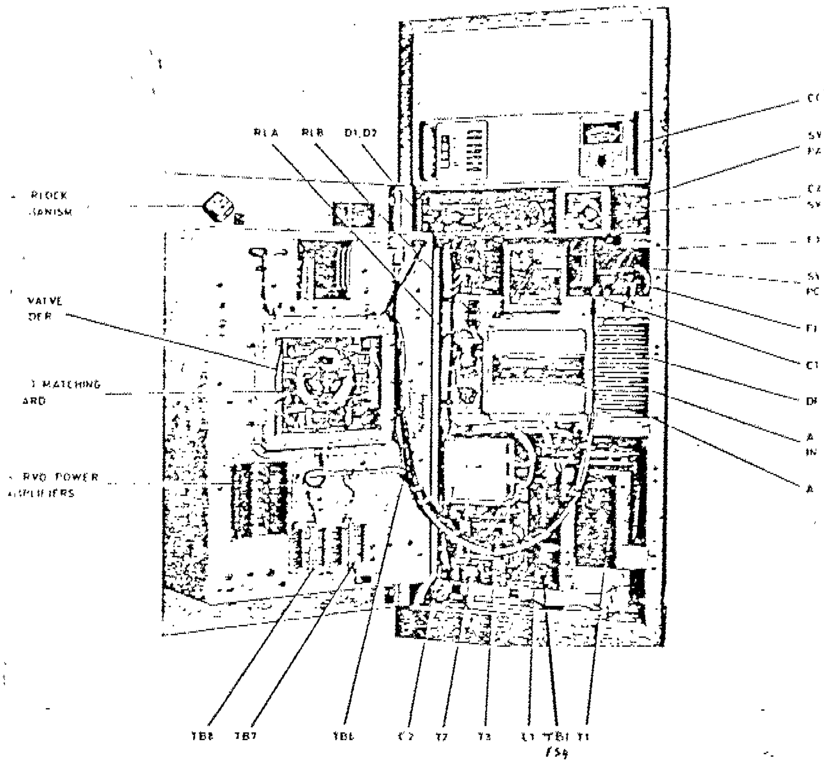


FIGURE 20

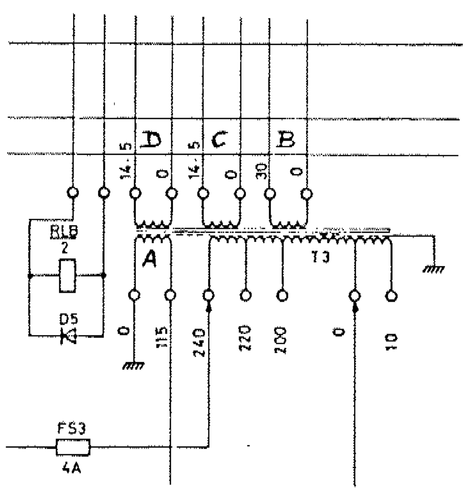
In bottom left hand corner amend SUPPLY LED to read:- POWER LED

FIGURE 21

In bottom right hand corner VEROPIN 15 amend SUPPLY to read:- POWER

FIGURE 47

Amend as shown below



Amendment to:

TA 1823 AUTO TUNED HF LINEAR AMPLIFIER
(CR 67910)

CHAPTER 12

Page 12-6

Para. 14 sub para (5)
Delete: "Tighten the screws ensuring the reading is not changed".

Para. 14
Delete sub para (8)
Insert sub para (8) to (13) as below.

(8) Select CONTROL EXTENDED at the control unit.

(9) Set the MA 1720 to TUNE, 1.600 MHz, STANDBY, then RESET. When the TA 1823 coils stop moving, adjust the left hand coil potentiometer carefully until the coil rotor is settled one turn up from the bottom end stop of the coil, with the servo still live. Depress RESET at the MA 1720 as necessary to keep the servos on.

(10) Repeat (9) for the right hand coil potentiometer.

(11) Tighten the screws to lock both potentiometers in position. Depress RESET on the MA 1720 and recheck the coil rotor positions.

(12) Select 14 MHz at the MA 1720 and depress RESET. Check that the coil rotors settle with their leading (upper) contacts above the upper coil shorting contacts.

(13) Set the Cabinet Master Switch to EHT SHORTED using the separate key.

CHAPTER 13 COMPONENTS LIST

Page 13-30
Amend R5 to read:- 3.3k Metal Oxide 2% 910111

ILLUSTRATIONS

Figure 16
Amend value of R5 to read:- 3K3

RACAL COMMUNICATIONS LTD

Amendment to:

TA1823 AUTO TUNED HF LINEAR AMPLIFIER
(CR67726, 67892, 68023, 67713, 67318, 67901)

Chapter 13 COMPONENTS LIST

Page 13-2
Amend R3 to read:- 1.8k Metal Oxide 2% 907723
Amend Part Number of C1 to read:- CD82901

Page 13-4
Amend Part Number of TR1, TR3 to read:- 932759
TR2, TR4 to read:- 932758

Page 13-14
Amend part Number of Heatsink TV3 to read:- 928172

Page 13-16
Amend value and Part Number of R13 to read:- 3.3k 910111

ILLUSTRATIONS

Figure 16
Amend R2 and R63 to indicate clockwise adjustment as shown below:

Figure 18
Amend R6, R7, R15, R31, R32, R38 to indicate clockwise adjustment as shown below:

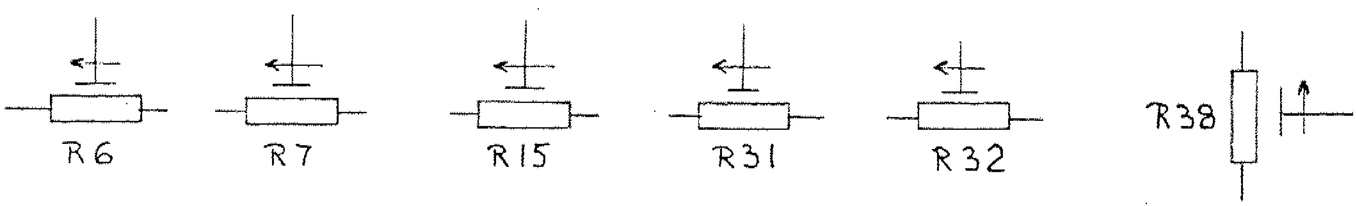


Figure 47
At EHT Monitor Board amend:- Pin 3 to read Pin 4
Pin 4 to read Pin 3